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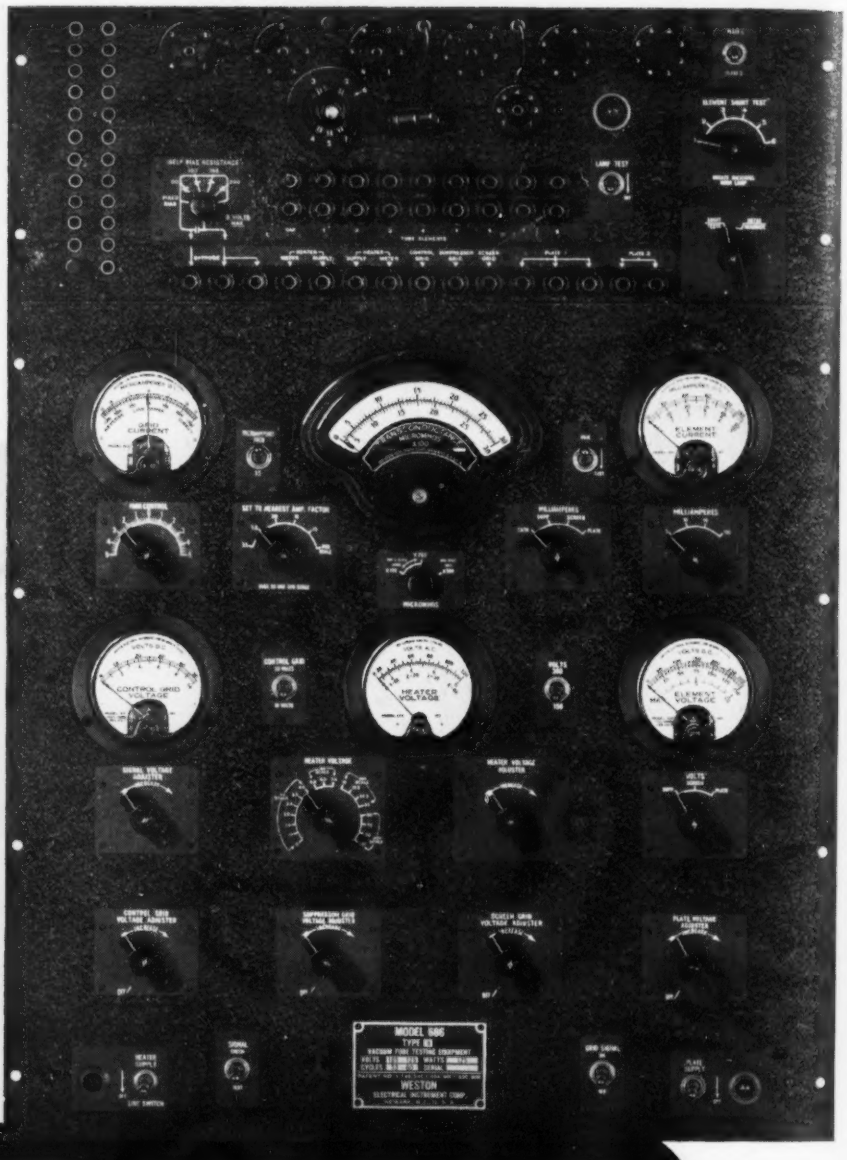

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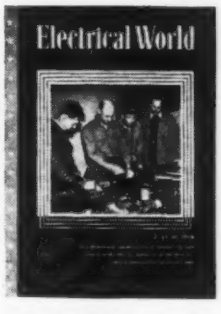

THE COVER — Apprentice cable splicers watch demonstration during veterans' training course. See page 60.

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World News offices: London, Paris, Berlin, Moscow, Prague, Shanghai, Bombay, Mexico City.

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ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to J. E. Blackburn, Jr., Director of Circulation.

RETURN POSTAGE GUARANTEED

Subscription rates: In the United States, $5 a year, $8 for two years, $10 for three years. Canada $6 for one year, $10 for two years, $12 for three years (Canadian money at par). Pan-American countries $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879.
Printed in the U.S.A. Contents copyrighted, 1946, by McGraw-Hill Publishing Company, Inc. All Rights Reserved.
Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W.C.2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office .....99-129 N. Broadway, Albany 1, N. Y.
Editorial and Executive Offices....330 West 42nd St., New York 18, N. Y.
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"LEAD SITUATION BECOMING PROGRESSIVELY WORSE"

Lead-Covered Cable to Remain in Short Supply

According to a recent report of the Civilian Production Administration "the lead situation is becoming progressively worse . . . it is feared that the inability to obtain lead will result in curtailment of production by lead consuming industries such as the battery, chemicals and cable covering industries."

...but Okonite has time-tried answers

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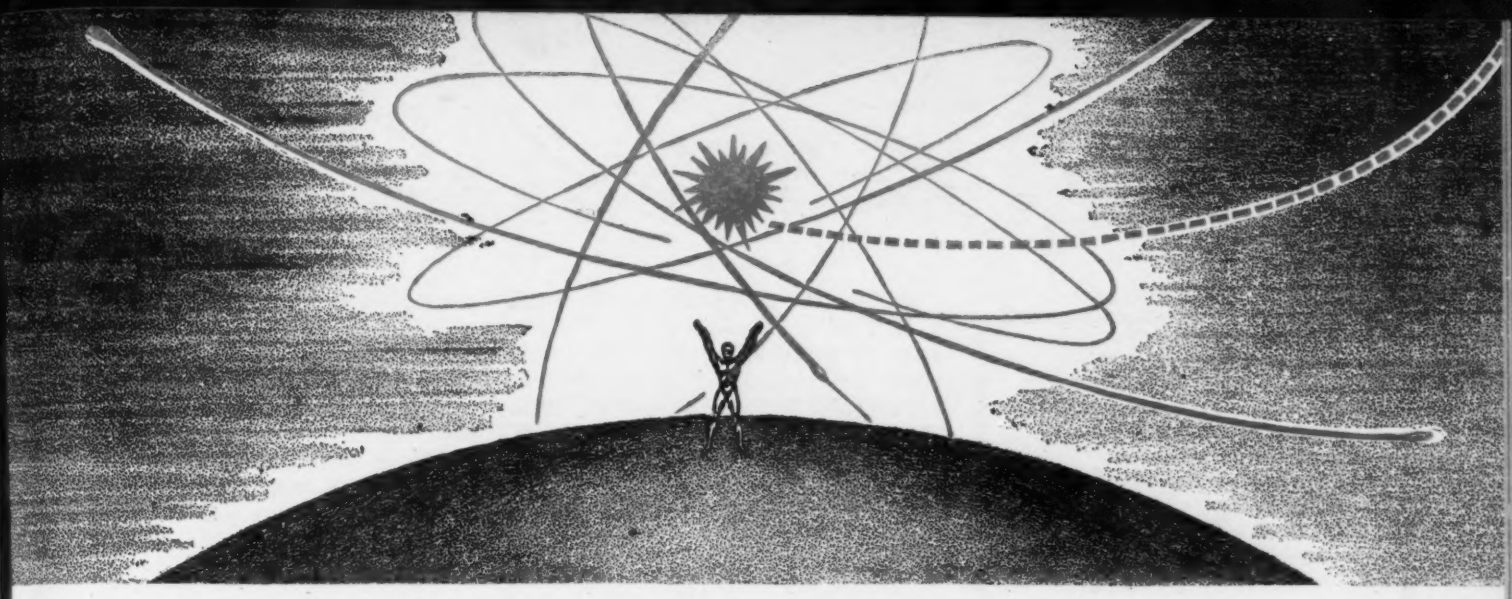

MAN vs ATOM—YEAR 1

WHEREIN WE SIGNALIZE THE FIRST ANNIVERSARY OF THE ATOMIC AGE, CONSIDER THE ALTERNATIVES INHERENT IN BOTH GOOD AND EVIL POTENTIALITIES OF NUCLEAR FISSION, THEN VENTURE A GLIMPSE INTO THE FUTURE

A YEAR AGO, July 16, 1945, at Alamogordo, New Mexico, man created the first atomic explosion. Most impressive events diminish in stature as they recede in time. This one grows bigger with each passing day. It truly marked the beginning of a new age.

As Year 1 of the Atomic Age ends and Year 2 begins, we are engaged in three portentous projects.

At Bikini Atoll we are detonating the fourth and, possibly, the fifth atomic explosions in the history of the world.

At Oak Ridge, Tennessee, we are building the first atomic energy plant for peaceful purposes.

Most important, in New York we and all the other United Nations are engaged in the first attempt to subject atomic energy to international control. Literally, the fate of the world hangs on this attempt.

As this introduction is written, the United Nations Atomic Energy Commission has just begun its work. People everywhere pray for its success—for their own sake, but even more for their children and for their grandchildren. If this Commission fails let everyone everywhere be warned: the world has taken a step toward destruction.

As we enter the second year of the Atomic Age, the nations of the earth are embarked on an atomic armaments race. There is no blinking that fact. We have had official notice served on us. Therefore, we must understand that unless the United Nations Commission can arrest the drift of events, we are moving toward a horrible war. The Commission must succeed.

The American delegate, Mr. Baruch, has brought to the Commission an ably thought out plan. It would internationalize nuclear science, and release for mankind the beneficent applications of atomic energy. But it would "control" atomic bombs only to the extent of giving the world brief warning of any nation's preparation to use them, so that we might have foreknowledge of disaster.

Therefore, the real and enormous task before the world becomes clear. We must end war. No other control of atomic weapons exists. If war comes, atomic weapons will be used. If they are used, our children who survive will curse their fathers. Understanding the consequences of failure, we *must* succeed.

Because we cannot succeed without knowledge, I have asked my associates at McGraw-Hill to condense into the following pages what we know at the close of Year 1 about this great new atomic force—its basic science, its possible uses and its political repercussions.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

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This Fateful Atom...

LOOKING BACK twelve months to the birth of Year 1, Atomic Age, we begin to sense the majestic import of the atomic bomb that blasted the naked desert at Alamogordo, N. M., on July 16, 1945. There man first shattered atoms in an explosive *fast-chain* reaction. Then came Hiroshima and Nagasaki.

In every case the fateful atom was either uranium 235 (U235), or plutonium derived from the action of U235 on U238. Every pound of U235 atoms split in these unprecedented blasts yielded the energy of 11.4 million kilowatt-hours, or 1400 tons of coal — slightly more for plutonium.

No matter where one mines uranium ore, the purified natural uranium (Fig. 1) always contains 99.3% of the "garden" variety U238, and a mere 0.7% of the precious U235.

An atom is like our solar system. The central sun is the nucleus — a bunched mass of protons and neutrons, each weighing one unit. The planets are electrons. Each proton has one plus electrical charge — each electron an equal negative charge. There must be as many negative electron planets as positive protons in the nucleus. This is also the "number" of the atom. Neutrons have no charge, but add weight.

The atomic number of uranium is 92 because the uranium atom always has 92 nuclear protons and 92 electron planets. The isotopes U238 and U235 differ only in the number of neutrons; U238 has 146 neutrons, and weighs 92 + 146 = 238 units. U235 has 143 neutrons, and weighs 92 + 143 = 235 units.

Ordinary chemical reactions, such as TNT explosions, release only a fraction of the modest energy of the whirling electrons in the outer atom. Nuclear reactions unlock the immensely greater energies which bind together the nucleus.

Even the gentle tap of a slow-moving neutron bullet will split the atom of U235 or of man-made plutonium into two medium-weight atoms, yielding also one to three spare neutrons plus energy. Thus these *fissionable* materials supply both their own bullets and a highly sensitive lot of high-explosive targets — a perfect setup for a *chain reaction* (Fig. 2).

Chain reactions work like chain letters. Neutrons from one nuclear explosion hit and explode other nuclei. But, since atoms are mostly open spaces a chain started in a small block of U235 or plutonium quickly dies out because most of the released neutrons escape from the block.

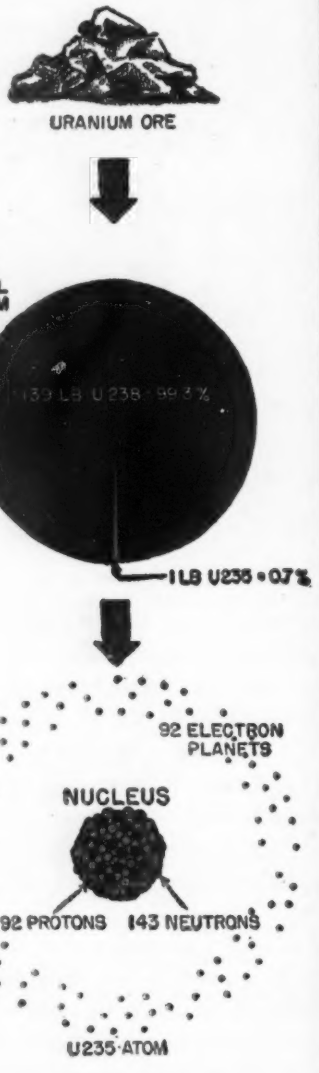
The bigger the block, the smaller will be the percentage of escaping neutrons, and the more left to split other nuclei. When the block is rapidly built up beyond a certain secret size the fragments of 1000 nuclear fissions split many more than 1000 additional nuclei. Then fissions multiply geometrically, and the block disintegrates with explosive speed and violence — as in a bomb (Fig. 3).

This bomb explosion is a fast-neutron chain. For economy and ease of control, uranium piles for the gradual release of nuclear energy for commercial purposes will normally use a lean fuel — that is U235 or plutonium diluted with U238, thorium or other less costly materials.

To maintain a chain reaction such piles must be large and artificially stimulated by using carbon blocks or some other *moderator* (Fig. 4) to slow many of the neutrons. Slow neutrons make more hits than fast neutrons because there is more time for them to be swerved from a straight path by the attraction of nearby nuclei, as shown below.

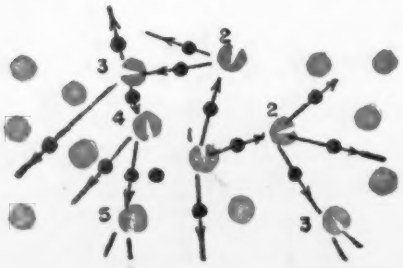
1 ORE TO U235

Only 0.7% of natural uranium is U235



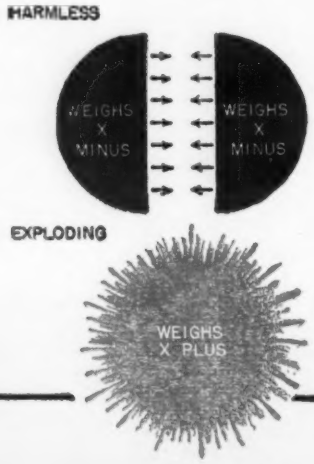
2 CHAIN REACTION

Fragments from earlier nuclear explosions smash other nuclei



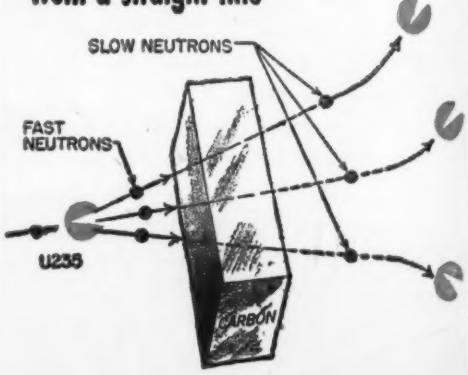
3 WHY BOMB EXPLODES

When block of rapidly assembled U235 passes secret critical size it explodes spontaneously



4 SLOW NEUTRONS MAKE MORE HITS

A slow neutron is more easily swerved from a straight line



can Serve Man . . .

THE FATEFUL U235 ATOM can serve man as a new, compact source of heat energy for power generation, comfort heating or industrial processing. Peacetime applications of atomic energy will use dilute U235 or plutonium as a "fuel," mixed with carbon or some other moderator to slow some of the neutrons and thus keep the chain reaction going.

The diluting agent may be either U238 or thorium, or both. These will do double duty, because neutron bullets convert U238 into the energy-yielding plutonium, and thorium into U233, which may prove equally serviceable.

Thus the commercial piles of the future will "burn" U235 to make other atomic fuels, plutonium and possibly U233, which in turn will deliver heat energy to the pile. In that way it will be possible to get from the pile far more heat than the equivalent of 1400 tons of coal for each pound of U235 split. This highly attractive prospect will speed the day when nuclear energy can compete with coal.

While already mechanically obsolete, the piles making plutonium for bombs at Hanford, Wash. (Fig. 1) reveal the basic principle on which future piles for power and heat will operate. The heat now wasted in vast quantities will be put to work. The plutonium, now removed for bomb manufacture, will be returned to the pile (or left in) as supplementary fuel.

ATOMIC POWER

The possible everyday applications of nuclear heat pictured in Fig. 2 have been recognized from the very first day of the Atomic Age. Year 2 will see the building of the world's first atomic power plant (a pilot plant) at Oak Ridge, Tenn.

Beyond question such installations will produce power, but it may be years or decades before they prove economical. To compete with conventional plants the piles must first be redesigned to run at temperatures high enough for good power-plant efficiency. Also the techniques of operating piles by remote control through the heavy radiation screens must be radically streamlined.

The Hanford piles run on natural uranium containing only 0.7% of U235. The typical commercial atomic power plant of the future will use more than 0.7% of U235 or plutonium, but less than 50%. This will avoid both the low efficiency of the too-lean mixture and the excessive fuel cost of the rich mixture. It will permit piles of moderate size and take maximum advantage of U238 and thorium as potential sources of plutonium and U233.

One should not expect U235 to replace coal generally in this generation, although a few central power stations and ships will try it out before Year 10 of the Atomic Age. Plants far from traditional sources of fuels may turn much sooner to uranium and thorium as concentrated heat sources, that may easily be transported even to remote corners of the earth.

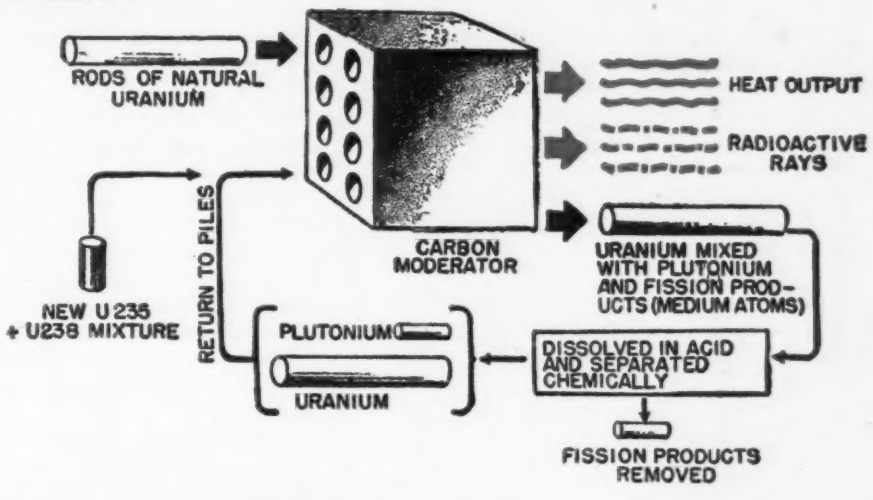
Atomic power, in forms now known, is impracticable for automobiles and small airplanes, because of the large initial investment in uranium and the need to carry 50 tons of shielding to protect riders and pedestrians against the deadly radioactivity accompanying nuclear fission.

RADIOACTIVE ISOTOPES

More immediately important than the heat and power applications of nuclear energy are the services that the radioactive byproducts of pile operation can render. Because these materials act chemically like their ordinary non-radioactive cousins, but can be followed and detected easily, they are expected to play tremendously vital parts in medicine and biology. For more details, see the last page of this section.

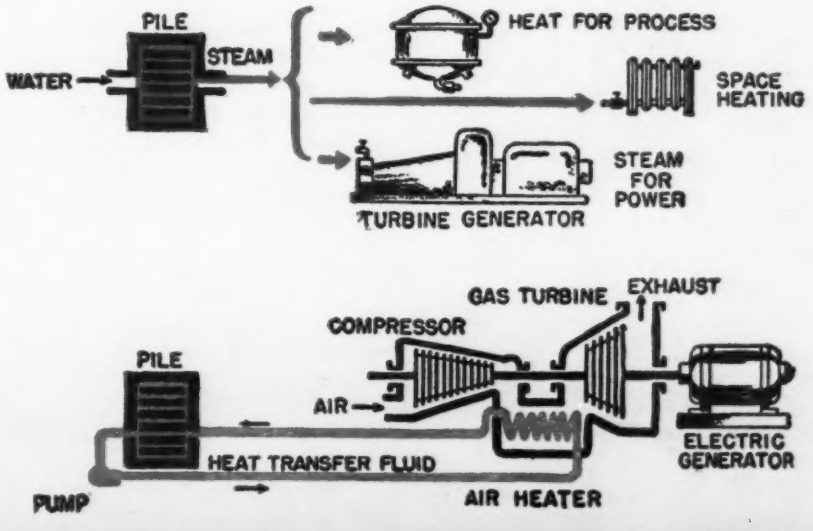
1 SLOW-NEUTRON PILE

Can make plutonium for bombs—or heat for power, process and comfort

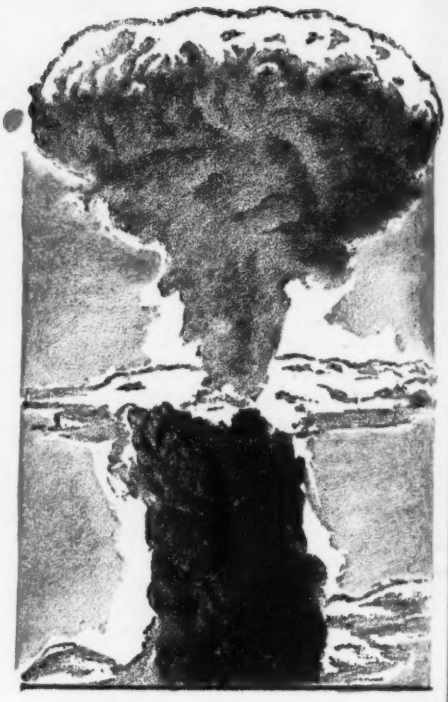


2 PRACTICAL APPLICATIONS

Include steam for turbines, process and comfort heating—also heat for gas turbines



or Destroy him . . .



A single improved atomic bomb can devastate ten square miles of city

URANIUM 235 and plutonium are now man's slaves. They will build or destroy as he orders. Man dreads this vast force only because he distrusts himself. War is proof that man in the mass has never achieved self-control. He has always sought better weapons; yet the perfect weapon now brings him no satisfaction for he sees in the atom bomb his own destruction as well as that of his enemy.

The ultimate benefits of nuclear energy may well surpass its present terrors, but the terrors are here now in awful dimension, and man must face them. He must pay this price for unlocking the wealth of the inner atom.

ATOMIC BOMB

This page, then, is about the atomic bomb. Nothing will be said here that is not either a certified scientific fact or a conclusion shared by the majority of the leading scientists, engineers and statesmen who have studied the matter.

As already explained, an explosive nuclear chain reaction spontaneously sweeps through a block of U235 or plutonium when the block is rapidly enlarged beyond a certain "critical" weight X. That weight is still a military secret; the official Smyth report vaguely suggests that it is more than 4 lb and less than 200 lb. Each piece of U235 in the dormant bomb must weigh less than X. At the desired instant of explosion the bomb mechanism assembles these pieces rapidly into a single piece considerably heavier than X.

The explosion itself drives the U235 pieces apart, thereby quenching the atomic conflagration before all the atoms are split, so the bomb efficiency is far less than 100%. For each pound of U235 (or plutonium) atoms actually split, the bomb releases the energy of 1400 tons of coal.

This explosion is mainly ordinary heat at work in unprecedented concentration. Bomb metals become incandescent vapor millions of degrees hot. This, and the enveloping sphere of glowing air, radiate a blinding flash that chars human flesh at half a mile and blisters at over a mile. There is a destructive shock wave (sound) and a second-long hurricane of unimaginable force — the outrushing of the expanding heated air. Deadly neutrons and gamma rays speed out from the bomb.

A single atomic bomb killed about 100,000 at Hiroshima. Fewer died at Nagasaki only because the circle of potential destruction included much vacant land. Bombs ten times more powerful can be made by the thousands in any major industrial country with the plants and the know-how. One bomb could saturate Minneapolis or downtown Manhattan.

Many experts estimate that a complete set of American atomic "secrets" and blueprints might save a foreign power two to three years at best in its race for atomic arms. With no help at all from us, any advanced industrial nation can, in five to ten years, acquire the raw materials, the plants, the know-how and enough bombs to knock out the big cities of any other country overnight. In Year 2 of the Atomic Age this arms race is already on.

It will not fail for lack of raw materials; every country has lean ores worth working for bombs.

There is no known defense against the atomic rocket attacking at mile-per-second speed

THE CHEAPEST DEATH

Cost need not deter, for the atomic bomb is by far the cheapest method of destruction ever devised. General H. H. Arnold estimates that atomic bombs can be manufactured *and delivered* for less than $500,000 per square mile of destruction.

Don't be misled by the two billion dollars America spent on a project that dropped only two bombs on the enemy. New plants can be built at a fraction of wartime cost, and the investment spread over thousands of bombs, not just two.

NO DEFENSE

So the bombs can be made in ample quantity and paid for, but can they be delivered? The answer is: "Yes; by the time the bombs are ready they can be delivered anywhere and overnight." If the defenses of the target country are weak, piloted planes can get through in ample number. Ten percent would be enough.

For more effective delivery radio-steered pilotless planes and rockets can carry the atom bombs faster than sound. Such weapons will be almost untouchable by either antiaircraft artillery or manflown fighters.

Greatest threat of all will be the transoceanic rockets. The German V-2 rocket, which never once was stopped by Britain's defenders, points one way. It needs only transatlantic range (with atomic propulsion) and an atomic bomb in the nose. Forty-six feet long, loaded with 7500 lb of alcohol fuel and 11,000 lb of liquid oxygen, the V-2 of World War II rose 60 miles in the air and arced 200 miles in five minutes to deposit one ton of TNT in London.

Seeing so many strange things come to pass, the man in the street cannot distinguish between possible miracles and the impossible variety. From the very start of the Atomic Age he has been hoping for a "ray" that will explode the atom bomb far off. Competent scientists and engineers say that cannot be.

The only way to bring down a 3500-mile-per-hour rocket at a safe distance is to chase it with your own 4000-mph rocket. You can't win at this game often enough to establish ironclad protection.

The only specific defense against the atomic rocket known in Year 2 of the Atomic Age is to disperse all cities and put key industries underground. This would be very costly in time, money and national morale.

MORE AND BETTER BOMBS?

Some will ask whether the U.S., as the most powerful industrial nation, could not build more and better bombs and carriers than any other nation. Probably yes, but there is still no real security. If the "weak" opponent has enough atomic weapons to destroy us once, what advantage is there in being able to destroy him twice?

Shooting first could protect us now, but not after the world is atomically armed. If we were to destroy the enemy's cities, we would probably miss his well-concealed and protected bomb magazines and rocket launchers. A few minutes later he could return the atomic fire. In brutal simplicity, that is the picture of future atomic war. Everybody loses.

At this point one grasps at another straw: "If everybody is to lose who would be so foolish as to start an atomic war? And didn't the Germans refrain from using gas for a similar reason?" Possibly yes. It *may* work that way. But in a world atomically armed to the teeth some nervous finger *may* pull the fatal trigger.

ONLY ONE WAY OUT

Throughout history each new offensive weapon has called out its appropriate defense. But now the offense leaps centuries ahead in a single bound and the defense lies almost helpless everywhere, unless some technical protection, unknown as Year 2 begins, can be devised.

The situation is extremely dangerous. There is no clear way out except through some sort of international action first to stop the atomic arms race and, before it is too late, to hobble war itself.

Can it be done? Perhaps not, but there is no alternative except atomic chaos.

...so he faces the Atomic Dilemma...

THE NUMBERED statements that follow in somewhat logical pattern are too fateful to be accepted on anybody's say-so. Every reader should test them in the light of his own information and understanding.

The points below sum up the conclusions of the previous article — and these in turn reflect a great mass of thought and discussion among leading scientists, engineers and statesmen close to the problem. To an amazing degree they concur on both facts and conclusions. For authoritative statements of their line of thought, in detail not possible here, the reader should see the recent book, *One World or None.*

THE DILEMMA

Nations must either face the probability of an atomic World War III, which would surely be the most deadly in history . . .

***Or,* the experts propose, yield both atomic weapons and war potential to international authority backed by superior force.**

What the Experts Say

1. In five to ten years any major industrial nation can make enough atom bombs to destroy all the major cities of any other country overnight.

2. This assumes no "secret" information or other help from us.

3. The necessary uranium ores will be at hand.

4. The cost will not be too high.

5. The bombs produced can then be carried thousands of miles by bombers, or by atomically powered guided missiles moving faster than sound.

6. There will probably be no effective military defense against such weapons.

7. Dispersing cities, and putting key industries deep underground, will give some protection if accomplished in time, but at incredible cost in money and human discomfort.

8. In a world atomically armed, nations can probably protect their bomb stocks and rocket launchers from enemy assault.

9. If so, nation A can destroy the cities of any other nation B, after which B's rockets will destroy the cities of A. Shooting first will not win an atomic war.

10. This knowledge may not restrain the trigger finger of a suspicious power.

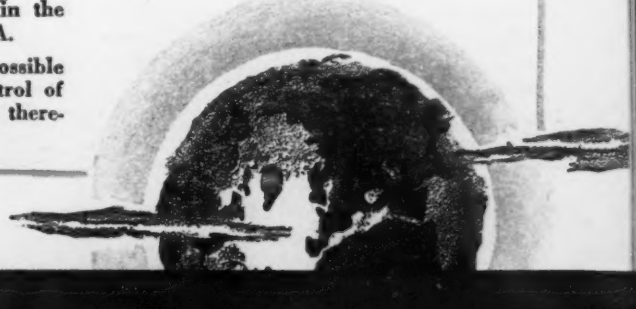
11. Having more and better atomic weapons than the other fellow won't help much if he has enough to destroy us. No use to kill a man twice or rebomb urban ruins.

12. Every nation is vulnerable in the Atomic Age, including the U. S. A.

13. National security will be impossible without (first) international control of atomic arms and (not too long thereafter) international control of all war potential, both backed by superior physical power.

14. If action to this end is long delayed, it may become impossible to halt the atomic arms race already started.

15. At best, the necessary degree of international control, with some real delegation of national sovereignty, will be a revolution in human affairs. It may prove to be humanly unobtainable at this time. If so, men and women everywhere must face the probability of an atomic third world war—by far the most destructive in all history.



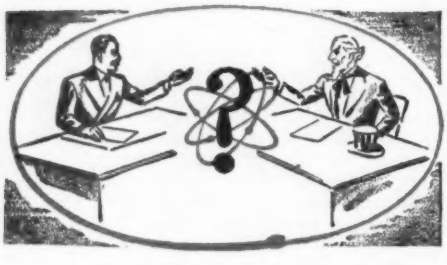
In this atomic age no nation can be safe through its own unaided might

...and the Great Debate unfolds

ATOM YEAR 1 has probably been marked by more debate on a single subject than any other twelve months in the world's history. Social, economic and political as well as purely technical issues have been pressing for realistic solution. Let us look at these issues and see where we stand:

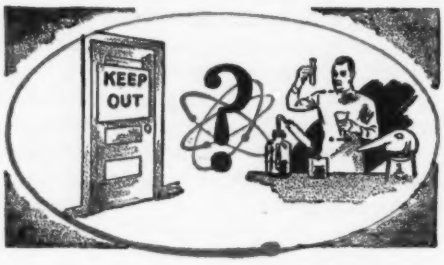
CIVILIAN VS. MILITARY

Because the atomic bomb is the world's greatest weapon, the armed forces would like to control it. But because atomic energy can also be used for peaceful, beneficial purposes, civilian control seems equally essential. These conflicting viewpoints had their strong proponents before the Congress which finally reached a fairly satisfactory compromise in the Atomic Energy Bill of 1946, setting up a competent civil board with which the armed forces will have continuing liaison. As we go to press, just before Year 2 of the Atomic Age begins, this bill has passed the Senate, but there is still a question how rapidly it will be enacted into law.



PRIVATE VS. PUBLIC

Atomic energy is "too big" and "too hot" to be handled privately. It must be nationalized and internationalized. The questions are *how* and *to what extent.* Fortunately, as the "boxes" on these pages show, there are means that may attain reasonable safety against misuse of the atom, and still do so without public control of many "non-dangerous" applications.



SECRECY VS. FREE SCIENCE

Throughout the first year of the Atomic Age hot debate has raged around "keeping the secret of the bomb." To prevent potential enemies from making atom bombs some have urged a complete blackout of all phases of atomic energy — even of the scientific fundamentals of nuclear physics. Others have sought immediate and complete disclosure of all bomb "secrets," both scientific and technological. These have held that such information cannot be effectively hidden, that secrecy blocks progress and breeds wars.

A year of debate has brought the great mass of vocal opinion to this middle ground: (1) Ease restrictions on the exchange of basic physical knowledge. (2) Release for industry's benefit many of the devices and methods developed for the bomb project. (3) Hold tight to specialized information on atomic bombs and bomb-material production until international safeguards are fully operative.

DOMESTIC CONTROL AS PLANNED IN THE ATOMIC ENERGY BILL OF 1946

McMahon Committee Bill contains the following provisions.

Policy. Declares it the policy of the U. S. to develop and utilize atomic energy to improve the public welfare, increase living standards, strengthen competitive enterprise and promote world peace.

Organization. Establishes the Atomic Energy Commission (AEC) of five administrators to direct four divisions on research, production, engineering, and military applications—to work in liaison with three committees from (1) the armed forces, (2) outstanding civilians, and (3) joint Congressional representatives.

Production. AEC to own and operate (under management contracts with industry if deemed desirable) all facilities for the production of fissionable materials, such products to be distributed with their radioactive byproducts under license for private industrial and medical research.

Military Application. AEC to engage in development work and produce atomic bombs as directed by the President, to be delivered only on his order to the Armed Forces.

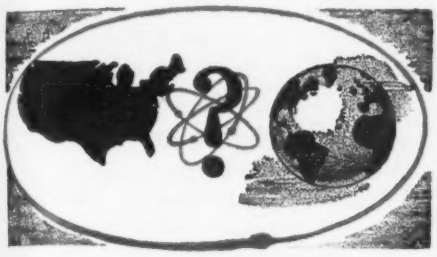
Industrial Utilization. Permits AEC to conduct research, design and manufacture equipment for atomic-energy utilization, license its use, produce and sell power obtained as a byproduct in the production of fissionable materials. Directs AEC to give widest safe scope to private initiative.

Control of Information. AEC to enforce a ban on the dissemination of restricted data that might be used to injure the U. S. or secure advantage to a foreign nation, yet to provide leeway for ultimately relaxing restrictions as future conditions warrant.

Patents and Inventions. No private patents permitted for production of fissionable materials or their utilization for military weapons, but AEC will justly compensate for such inventions, when made by private citizens. Patents for non-military applications may be purchased or condemned by the AEC only when public interest is affected.

Appropriations. "Such sums as may be necessary and appropriate to carry out the purposes and provisions of the act" *plus* unexpended funds of the Manhattan Engineer District.

while Time runs out



NATIONAL VS. INTERNATIONAL

Born of nationalism, the Atomic Age began when three nations discovered a weapon that today gives them the greatest military power on earth. The prime question is: Shall the atom remain the servant of its conqueror, nationalism?

During Year 1 of the Atomic Age the Truman-Atlee-King declaration, the masterly report of the State Department's atomic consultants, and the U.S. representative on the United Nations Atomic Energy Commission, have all called for international control of atomic energy. Year 2 will start with no such control. This failure to decide and act is in part a natural result of the extreme difficulty of the problem and the obvious dangers of unwise decisions. Nations everywhere face a triple dilemma in this Atomic Year 2: the dangers of nationalism, the dangers of internationalism, the supreme danger of not being able to make any decision in time to meet the atomic bomb threat.

INTERNATIONAL CONTROL AS PROPOSED BY THE U.S. TO U.N. ATOMIC COMMISSION

Baruch statement follows constructive path laid out by Atomic Consultants in "Acheson-Lilienthal Report."

The Plan. The U.S. has proposed that all nations band together to outlaw the use of atomic energy for war and to promote and harness its development for the benefit of mankind. To this end an International Atomic Development Authority would be set up, and to it the U.S. would turn over, at various stages of its organization, all atomic bombs, know-how, raw materials, facilities, and stockpiles of fissionable material. Thus IADA eventually would supersede national authorities on some matters and supplement them on others.

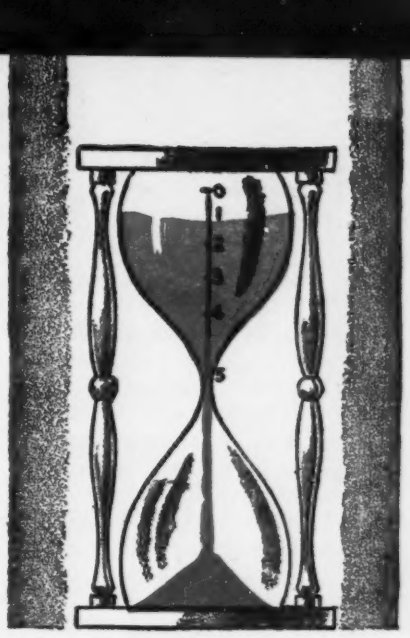
Owner and Operator. IADA would take over from national authorities or private ownership full management and control of all atomic energy matters that afford a possible threat to World security. These include:

1. Raw Materials—Supplies of uranium and thorium to be inventoried, controlled, and developed by IADA.
2. Facilities—IADA to control and operate plants producing fissionable materials and to own and control their products.
3. Research—IADA to undertake research and development on all aspects of atomic energy and to possess exclusive right of research on atomic explosives.

Private Initiative. Will have its chance to push forward the use of atomic energy for peacetime (non-dangerous) purposes. With IADA providing raw materials and carrying out necessary inspection, national and private enterprise may operate "safe" power piles, and produce and use radioactive isotopes for research, clinical and other applications. Radioactive isotopes produced by IADA also can be distributed for peacetime use.

The Mechanics of Safety. No plan is a certain guarantee against future atomic war. This plan should, however, prevent surprise attack with atomic weapons; for IADA is to buttress positive ownership or management controls with wide powers of inspection. Obviously, successful inspection rests on complete freedom of access or egress in any area.

Sanctions. At the heart of the plan lies the problem of penalty for violation — a matter for profound statecraft. To the U.S., one aspect of sanctions appears crystal clear: Here is an area where the veto right now held by the five great Powers must be redefined if it is not to be incompatible with the meaning and purpose of the proposed control.



Leading industrial nations can produce atomic bombs in five years, competent scientists announced after Hiroshima. Already one year of the precious five has been consumed in debate without international action. Soon it may be too late to check the growing momentum of the atomic arms race.

TIMETABLE—ATOM YEAR 1

1. **July 16, 1945.** World's first atomic bomb detonated in New Mexico.
2. **July 26, 1945.** President Truman and Prime Minister Churchill issue Potsdam ultimatum threatening Japan's destruction if she continues.
3. **August 6, 1945.** Atomic bomb dropped on Hiroshima.
4. **August 9, 1945.** Atomic bomb hits Nagasaki.
5. **August 11, 1945.** Army releases Smyth Report on "Atomic Energy for Military Purposes."
6. **August 14, 1945.** Japan accepts terms of Potsdam declaration.
7. **November 15, 1945.** Truman-Atlee-King issue declaration of intention and procedures looking toward international control of atomic energy by United Nations.
8. **March 28, 1946.** State Department issues Acheson-Lilienthal Report on the "International Control of Atomic Energy."
9. **April 12, 1946.** Manhattan Engineer District announces program for experimental development of atomic power.
10. **June 1, 1946.** "Atomic Energy Bill of 1946" passes Senate unanimously, is referred to House of Representatives.
11. **June 14, 1946.** First meeting of United Nations Atomic Energy Commission (Bernard Baruch as American member). Manhattan District announces availability of radioactive isotopes for research use.
12. **July 1946.** Joint Army-Navy tests of atomic bombs at Bikini.

...but if Man Masters Atom...

IF MUTUAL DESTRUCTION by the atomic bomb can be avoided, the first century of the atomic age will bring immense advances in scientific knowledge, health and living standards. Already many prospective benefits can be outlined, but those we can neither foresee nor suspect may be even more important.

This prediction is grounded in scientific experience; the most fundamental discoveries have always been the most fruitful. The study of molecules gave us chemistry. Faraday's experiments with electricity and magnetism are the foundation stones of the great electrical industry. Can one expect any less from an understanding of the heart of every atom?

BENEFITS

Atom-splitting benefits clearly visible today fall mainly in three classes: (1) heat and power applications of the uranium piles; (2) general industrial applications of equipment and methods originally developed for the bomb project; (3) chemical, biological and medical uses of the "tagged atoms" (radioactive isotopes) now abundantly available from pile operation.

It is now evident that the energy yield of the U235 in an atomic pile can be multiplied many times by returning to (or leaving in) the pile the plutonium and possibly the U233 produced respectively from the U238 and the thorium in the pile. This is an indirect way to "burn" inexpensive U238 and thorium, and thus greatly extend the supply and reduce the cost of atomic fuels.

POWER APPLICATIONS

Although present piles run at low temperatures, it is certain that temperatures high enough for the efficient operation of steam and gas turbines will be attained. Already an experimental atomic power plant has been ordered. Atomic power for certain remote installations (say, for heating Arctic airports) may not be far off.

In five or ten years uranium piles will be driving a few experimental ships and submarines. In 20 or 30 years uranium may begin to compete widely with coal as a fuel for suitably situated large central heating and power plants. The 50-ton minimum weight of shielding rules out nuclear power for automobiles and small piloted planes.

SPECIAL USES

Some day ultra-high temperatures from splitting atoms will be used for special industrial operations on metals and other materials. Even the dread atomic bomb might easily serve peaceful ends — blasting lakes in deserts, changing the course of rivers, leveling mountains.

INDUSTRIAL BYPRODUCTS

The special industrial equipment and methods developed for the bomb project will find hundreds of important uses — mostly for purposes unrelated to atomic energy. These developments include pumps with neither seals nor leaks, leak detectors of amazing sensitivity, ultratight welding, a portable mass spectograph for quick and automatic gas analysis, new ways of handling corrosive and poisonous materials, new diffusion barriers for the separation of gases and of petroleum products.

TAGGED ATOMS

Yet more important than any of these, in the long run, will be the hundreds of radioactive isotopes now available as by-products of pile operation. Chemically indistinguishable from the ordinary forms of the elements, these isotopes serve as tagged atoms or "spies" if mixed with common stable atoms of the same species. They "fly with the flock," and can later be identified as surely as banded birds. With these amazing tools of research, the course of any element or compound may be traced through the bodies of men, animals and plants. Similarly, tagged atoms may be used in studying the course of many kinds of industrial and chemical operations.

BIOLOGY AND MEDICINE

A suspected hyperthyroid condition can be diagnosed by feeding the patient a minute measured amount of radioactive iodine. The click of a "Geiger" counter placed on the patient's neck will tell (1) what percentage of the swallowed iodine concentrates in the thyroid cells and (2) how rapidly that concentration is accomplished — giving a definite indication of the state of the gland.

In similar fashion the radioactive isotopes of hydrogen, oxygen and carbon will trace out the intricate transformations of carbohydrates and proteins in the human body. Radioactive phosphorus will explore the bones. Radioactive iron will show how and where blood cells are formed. Radioactive sodium will time the circulation of blood.

USES IN INDUSTRY

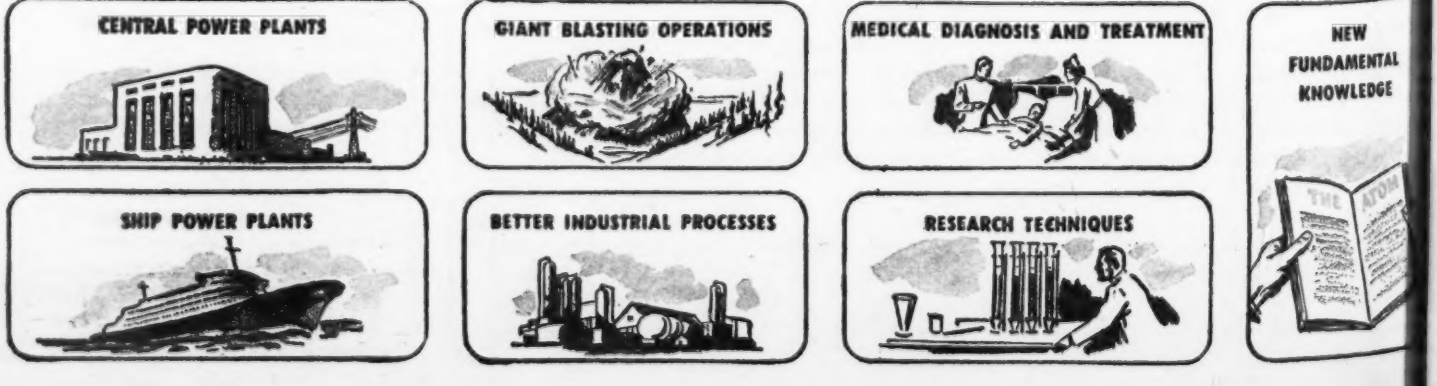
In chemistry the radioactive isotopes will speed the understanding of metallurgical and organic reactions. In industry they will measure flow, detect leaks, and do other useful work.

Meanwhile the uranium piles will be manufacturing certain radioactive isotopes that can serve as cheap but effective substitutes for high-cost medical radium.

KNOWLEDGE COMES FIRST

It is already clear that the chief benefits of atom splitting will come first as new scientific knowledge rather than as new engines and gadgets. But in the long run man's new understanding of the inner atom will enrich the whole range of human activity. This has always been the case with less fundamental discoveries in science. It can hardly be less with this most fundamental discovery.

ATOM SPLITTING WILL SERVE MAN IN:



Electrical World

JULY 20, 1946

In Excess of the Code

ALMOST three months ago the National Electrical Manufacturers Association suggested to the American Standards Association that it develop an ASA standard for a state inspection law and for a municipal electrical inspection ordinance. Earlier this month the International Brotherhood of Electrical Workers took strong exception to the proposal.

That these two groups should have opposite views on this subject is not something new. NEMA has for years contended that local restrictions beyond those set up in the National Electrical Code prevented the public from enjoying the full economic benefits of mass production and were therefore expensive. On the other hand, I.B.E.W. has always favored wiring standards in excess of those in the Code and has encouraged higher local requirements.

In spite of what is claimed, the Code is not truly a set of minimum safety rules, for over the years there have crept into it numerous wiring practices that bear little or no relation to minimum safety, however desirable they otherwise might be.

To accuse NEMA or any of the other commercial groups that make up the Electrical Committee, N.F.P.A., of exercising commercial pressure in revising the Code is very much like the pot calling the kettle black. I.B.E.W. is just as much self-centeredly interested in Code revisions and applications as any other group, and for the obvious purpose of protecting labor's work hours. If labor could be made to see that the higher requirements in effect act to reduce the total work hours then we would expect to see labor act differently.

And that is exactly what is required today. From every corner we are hearing that building codes and ordinances have become so restrictive that it is almost impossible to provide the wage earners with homes equipped with modern conveniences at a price that can be afforded. Government officials who have been close to the construction market have almost without exception stated the belief that a bigger and better market would be forthcoming if Code restrictions were reduced to safety minimums.

Nor is the electrical industry the only offender; the same is true of plumbing, carpentering and others. Restrictions are everywhere, not always to protect the public although that is the peg on which they are hung, but to protect some interest —sometimes labor and at other times some other branch of the trade. In this present instance, however, NEMA is offering something that can be of benefit to the public and, through the larger volume that comes from standardization and lower cost, to other branches of the electrical industry as well. The only trouble is that, while in the past two decades many cities have been convinced of the advantages of standardization and uniform Code administration, the other branches of the industry have not been assured of benefits to the point where they not only accept the idea, but insist on doing their part to further it.

There can be no conflict with high standards of wiring, but in our opinion they should not be made mandatory. If they are beneficial they can be sold and the public made to want them—not made to have them.

There is a big job ahead of the electrical construction industry, and employment almost without limit, if the work can be done at a price the public is willing to pay. Part of the difficulty lies in the local ordinances. This is not something for members of the industry to squabble about, but rather something that calls for cooperation to find an answer and that right soon.

VETERANS' TRAINING COURSE

Turns Out Journeymen Craftsmen

I. L. BATEMAN, *Los Angeles Department of Water & Power*

Nine apprentice training schools with enrollment of 414, of which 331 are veterans, will provide future linemen, cable splicers, servicemen and conduitmen in utility training program

FRESH from the Army, Navy and Air Force, 331 young Americans are going to school at the Los Angeles Department of Water and Power to become linemen, cable splicers, electrical servicemen and conduitmen in civilian life. The apprenticeship training program for regular employees got under way three years ago with the establishment of a four-year lineman's training school. This covered a year's work with line patrolmen on steel tower transmission lines and three years' work in overhead distribution work with progressively more line work duties until the final year, when the assistant lineman does lineman work under the continual direction of a thoroughly experienced journeyman lineman. Apprentices participating in the training program are required to attend a three-hour class two nights a week on their own time. At present, nine separate apprenticeship schools are in operation in the Department, training 414 apprentices to be journeymen craftsmen.

Apprenticeship Law

The apprenticeship training schools are established according to the State of California apprenticeship law and Public Law 346. The state law makes provision for the establishment of these classes through a local joint apprenticeship committee selected by the employer and the employee organizations in any trade. Public Law 346 provides federal government aid for the readjustment in civilian life of returning World War II veterans.

In the establishment of an apprenticeship training class, the state apprenticeship administrator acts as secretary of the apprenticeship council, cooperates in the formation of the joint apprenticeship committee and advises with them on problems affecting labor standards. The state or local board responsible for vocational education is responsible for the preparation of trade analyses and outlines of instruction, coordination of instruction with job experiences, and the selection and training of teachers. In the nine Department classes, highly skilled and thoroughly experienced employees of journeymen and foremen levels have been selected as instructors.

Advisory Committee

The function of the joint apprenticeship committees is to work in an advisory capacity with the employer and employees in matters regarding schedule of operations, application of wage rates, working conditions for apprentices, the ratio of apprentices to journeymen to be employed, and to aid in the adjustment of apprenticeship disputes as they affect labor standards. Each employee desiring to enter an apprenticeship class first makes application to the local apprenticeship committee, which sees that each apprentice is correctly registered according to the provisions of the standards set up and approved for the class. This local committee hears and decides all complaints having to do with standards of apprenticeship, subject to an appeal to the administrator should there be an aggrieved party. The committee also offers constructive suggestions for the rotation of job experience for apprentices and endeavors to have these suggestions applied. The local committee of seven members usually consists of a principal electrical engineer, a senior electrical engineer and a general superintendent representing the employer, and three journeymen employees of the particular craft as employee representatives and also one educational advisor from the local school board.

Apprentice standards are set up by the local joint committee and approved by the administrator of apprenticeship for each class and cover (a) committee duties, (b) definition of apprentice, (c) terms of apprenticeship, (d) work training, (e) school instruction and deportment, (f) identifications, (g) continuous employment, (h) apprentice wages, (i) agreement for apprentice hours, (j) ratio of apprentice to journeymen, (k) granting of certificate and (l) modification of rules and regulations.

Course of Study

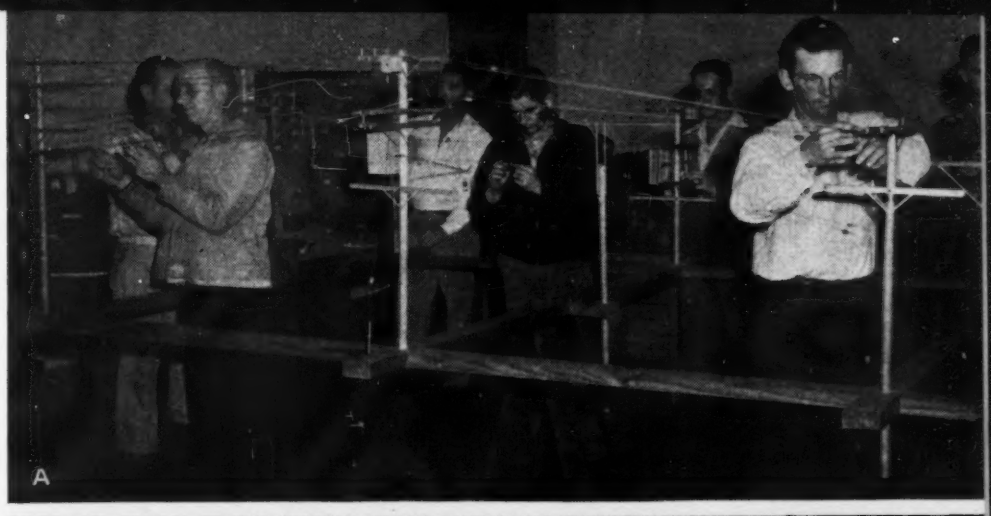
The course of study for apprentices is usually limited to those who are actually engaged in the particular trade with properly qualified employers. Apprentices enrolled in classes are required to attend classes for an average of not less than six hours weekly for a minimum of 240 hours per year. In training the apprentice, every attempt is made to train him in the things which

he will be required to do on the job by following the policy that "we learn by doing."

The course of study consists of a review and study of the fundamentals of electricity, electrical circuits and equipment, tools and materials, work methods and techniques, and safety and first aid. During practically all of the school course the apprentice is given an opportunity during the class periods to work part of the time with tools under the supervision of the instructor along with the study of theory, methods and fundamental information obtained from manuals, books and blackboard instructions. Experience has shown that a well balanced class program does much towards maintaining a high level of interest in the school work.

Subsistence Benefits

The apprenticeship classes, which are approved by the division of apprenticeship standards of California, are approved by the Veterans' Administration for veterans to obtain subsistence benefits. Under Public Law 346, provision is made for single veterans to obtain benefits of $65 per month or a veteran with one or more dependents may receive $90 per month while receiving apprentice training, provided that his apprentice wage plus subsistence benefit does not exceed a journeyman's wage. On account of the highly specialized nature of craft work and constantly changing methods, tools and materials in the electrical utility field, the importance of craft training cannot be minimized since it is the base upon which all plant work rests. The Department of Water and Power has benefited greatly by having about 400 employees in these apprenticeship training schools because the very finest skills and techniques in craft work and Department methods are given to the employees. These schools will provide a source of well trained journeyman craftsmen in the future, provide assistance to veterans and prevent considerable labor turnover in apprentices.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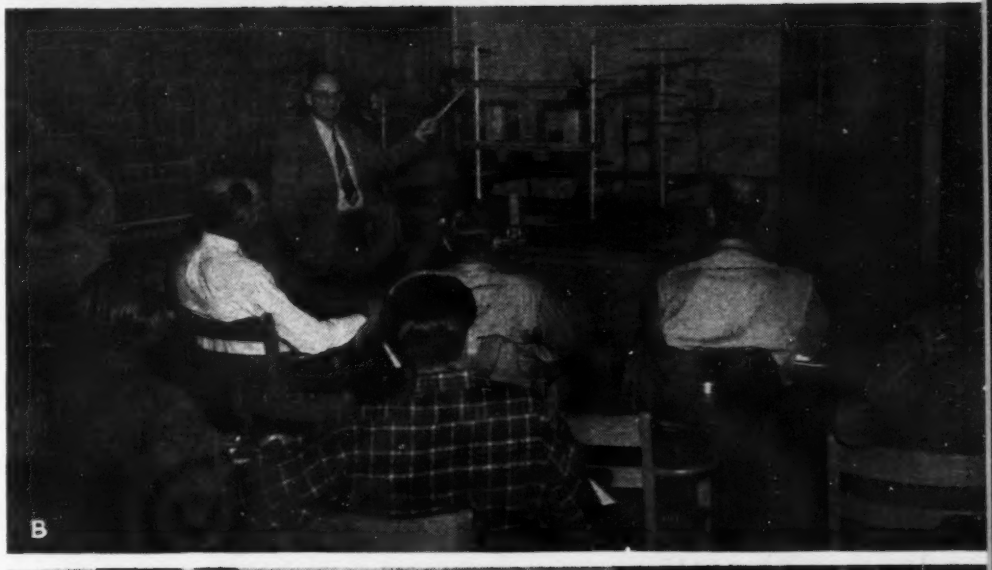
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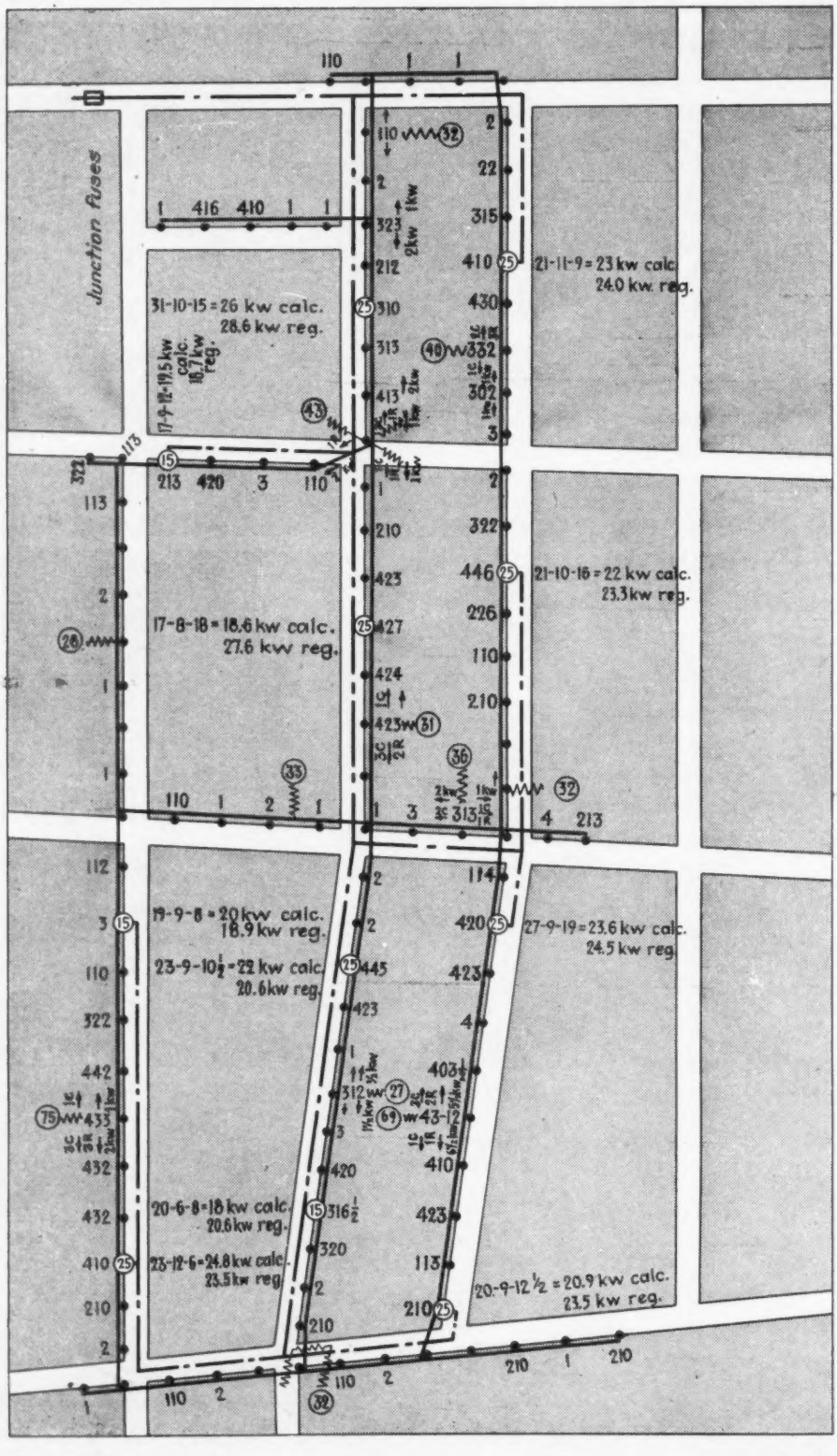
LINEMAN APPRENTICES (A) building model lines and (B) use of model lines in lecture work. Apprentice cable splicers (C) watching a splicing demonstration. (D)—Senior cable splicer finishing a single-phase splice in 138-kv., 1,500,000-cir. mil oil-filled cable

Lessons from

SECONDARY BANKING

K. L. PARTRIDGE, *Distribution Engineer, Hartford (Conn.) Electric Light Co.*



HARTFORD ELECTRIC LIGHT CO.'s experience in banking distribution transformer secondaries goes back many years and has been a useful guide in the design of secondary systems. Soon after the end of World War I the company realized that something was wrong with some of the systems then in operation, as there was trouble from cascading. Before discussing the results of studies which followed, a few words about Hartford's main distribution system may be in order. This consists of 2-phase, 4.8-kv. radial feeders stepping down to 230 volts single or 2-phase as required. These feeders may supply completely overhead areas, fully underground areas, or a combination where primaries and transformers are underground, with overhead secondary conductors.

Fusing Practice

Transformers in the completely overhead areas are fused on the primary side only, while in fully underground areas or in districts where primaries and transformers are underground, fusing is provided on the secondary side only. Fuse sizes are: Overhead, 350 percent (approximate) of full load current on a 10-sec. clearing time; where primaries and transformers are underground, 185 to 230 percent using code fuses; and on fully underground installations the company uses 350-amp. copper link fuses on 25-kva. and

FIG. 1—Typical banked secondary section showing load division calculation. Circled figures represent customer-sections at point of division where sums of customer-moments in both directions are equal.

Opposite pole locations, a number 423 means 4 customers, 2 ranges, 3 kw. of off-peak water heating.

Opposite transformer locations a number 21-10-6 means 21 customers, 10 ranges and 16 kw. of off-peak water heating. The calculated and measured transformer loads are also indicated

PRACTICE

Methods of avoiding cascading troubles on distribution circuits— Analyses of "load moments" aid allocation of transformers . . . Studies of transformer failures and load tests useful

500-amp. copper link fuses on 50-, 75- and 100-kva. transformers.

The well known potential benefits of banking transformers are reduction of flicker caused by starting fractional horsepower motors, more efficient copper and transformer loading, and improved service continuity.

Causes of Earlier System Troubles

It was found in studying cascading troubles:

1. Overloaded transformers played an important part.

2. Two, three or more transformers in a straight line were in trouble where the loss of an end transformer dropped its entire load on an adjacent transformer, causing its fuses to blow, and so on down the line.

3. Poor secondary arrangement other than in 2 (above); i.e., open loops where they could have been closed, or too many free ends, so that the loss of a transformer forced its load to go in one direction only.

4. Poor transformer arrangement with regard to load distribution.

5. Poor transformer fuses and fuse boxes causing false fuse failures.

As a result of these studies, five fundamental principles for the design and maintenance of secondary systems were set up:

1. No less than three transformers per system except in very special cases. These three to be arranged so that all the load of one transformer cannot fall upon the next transformer in case of fuse blowing.

2. No transformer arrangement where the loss of one transformer would cause its entire load to drop upon the next adjacent transformer.

3. Transformer sizes to be as nearly equal as possible. Hartford banks sizes 10, 15 and 25 kva. A 10- and a 25-kva. are never adjacent, though in the same section of the system. They are far enough removed from each other so that the loss of the 25-kva. transformer will not seriously affect the loading of the 10-kva. In general we never install adjacent transformers more than one size apart.

4. Provide a reasonably accurate method of estimating the load per transformer for use in company office. The loading chart used and shown was developed by us and is based on residential conditions as found in Hartford for estimating the load per transformer. This chart permits 150 percent load on transformer peak. It is simple to use, for by knowing the number of customers and electric ranges connected to a given transformer, the proper size of transformer to use is shown on the horizontal scale at the bottom of the chart.

Some method of continuous load supervision is necessary. Knowledge has been had of some companies who neglected this phase when adding electric ranges in considerable numbers. As a result a multitude of small reconstruction jobs and transformer changes piled up in the late fall when loads began to peak.

Customers per Transformer

To get the number of customers per transformer when transformers are banked, the system is laid out as shown. Moments about each transformer are taken; i.e. the number of customers per pole (ranges being converted into equivalent customers), times the number of spans from the transformer. By applying this method between two adjacent transformers and summing the moments as one progresses from one transformer toward the other, one arrives at a point where the two moments become equal. This is the point where the load divides. By continuing this procedure on all the transformers, one gets all the load division points. It is then simple to count the connected load per transformer, turn to the loading chart and find the transformer size.

While this method may lack something in rigor, it works with sufficient accuracy for the problem in hand.

On Hartford's system the primary supply to the transformers is usually tapped off the main primary backbone through a set of fuses. This gives a means of isolating a group of transformers if cascading should ever occur. It is practically never necessary to use

FIG. 2 — Chart showing transformer sizes required for given number of customers without electric ranges and additional load imposed where ranges are added in numbers shown. Thus, 21 customers using no electric ranges could be satisfactorily served by a 7.5-kva. transformer. If 10 ranges were in service in this group, by following the line for 21 customers across the chart to the right to the diagonal line corresponding to 10 ranges, and then dropping down to the abscissa Transformer Size, kva., a 15-kva. transformer would just meet the conditions. If these customers had 12 ranges, a 25-kva. transformer would be necessary.

Based on 150 percent transformer rating and 400 watts per customer

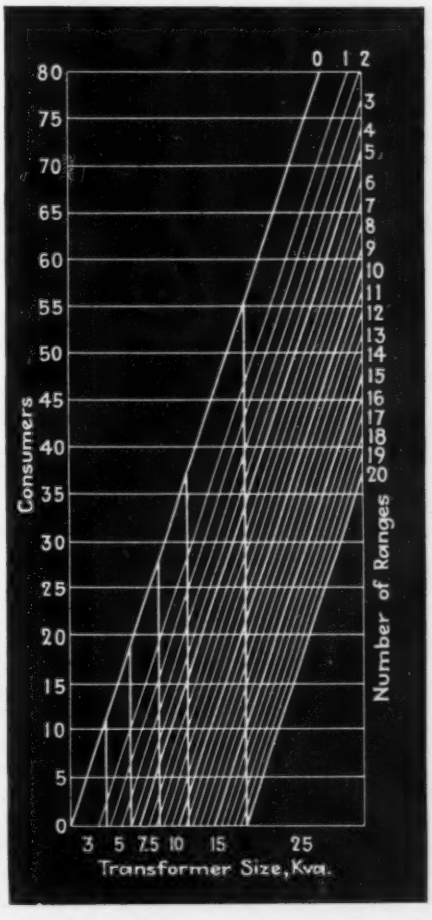


TABLE I

Transformer Failures

1934-1945

All Winding Failures 10-25 Kva. Incl.

Year	Lightning	Overload	Secondary Faults	Service Faults	Water In Tank	Unknown	Total Failures	Total in Service	Percent Failures
1934	2					2	5	998	0.50
1935	4					1	5	1005	0.50
1936	2					3	5	1050	0.48
1937	1	1				3	5	1142	0.44
1938			3				3	1188	0.25
1939	3	4	2	1		1	11	1234	0.89
1940	1						1	1327	0.08
1941	1				1		2	1439	0.14
1942	2			2			4	1507	0.27
1943	3	3					6	1535	0.39
1944	4	1	1			1	7	1545	0.45
1945		1	1			1	3	1582	0.19
						Average			0.37

them for this purpose, but they give a feeling of security to the operating department.

Adequate Load Surveys

5. Provide adequate load surveys either by spot tests or recording devices to check transformer loading annually. This is done to check loads on all sections of the system, load growth, etc. Up to 1937 Hartford relied entirely on spot tests between 6 p.m. and 8 p.m. in November and December. Since then, due to relatively high range density which peaks between 5:30 and 6 p.m., and changes in working schedules within our company, we have substituted the Lincoln half-hour ampere demand meter more and more for this work, now using it entirely. This costs more, but the data obtained are immeasurably more valuable and reduce the office work to translate it.

General Design Problems

In applying the banked transformer idea, one seldom starts with a complete new area. The issue is usually a redesign of existing areas into a banked system of transformers, or, as in new districts, a progressive building-up of such a plan. In either case the procedure is much the same. Transformer locations are first determined based upon economical spacing, in our case 900 ft. maximum, then calculating transformer size as outlined above. In fully underground areas, transformer secondaries are also banked. However, Hartford's underground area is almost entirely commercial, and no method of load estimating is used. Instead we rely upon the annual load surveys on the transformer banks and make such adjustments as seem required.

Operating Experience

We have experienced no serious transformer troubles. Transformer failure rate is low. Table I gives the failure rate of 10-, 15- and 25-kva. transformers for the past 12 years. Average transformer failure rate for this entire group was 0.37 percent per year.

Table II is a summary of transformer failures in the above ratings in the past 12 years on systems of banked transformers. In but three cases was service interrupted to the secondary system. Occasionally transformer fuses blow, which usually results in a complaint of low voltage. A subsequent service call corrects this by fuse replacement. Flicker and low voltage complaints are low, the majority of these occurring on the free ends of the secondary system. In the fully underground system, secondary faults usually burn off, with an occasional secondary branch or transformer fuse failing.

Hurricane Experience

The hurricane of September, 1938, gave a good test in areas having overhead secondaries, but primaries and transformers are underground. A very high percentage of these transformers are banked. In spite of the considerable damage to these secondaries, no area, so far as we can discover, was out completely. Secondaries were broken between banks and fuses blown here and there, but everyone with a house service intact had electrical service, though voltage may have been low. No transformer failures resulted.

Based on 1938 figures 33.5 percent of our bankable transformer sizes, i.e., 10, 15 and 25 kva., were banked. Expressed in another way, 36.6 percent of the transformer kva. was banked.

The results of our 1945-1946 load testing program are shown in Table III. These tests were made with either Lincoln series ½-hr. demand meters in the primary lead or Maxi-meters with Lincoln elements clamped on the secondary leads. We feel that the percent loading indicates the value of load supervision.

The Hartford Electric Light Co. has undoubtedly through the years experienced all the troubles claimed for transformers banked without secondary protection, but we feel that with proper design and supervision, anyone can reap the benefits of this system of distribution provided the five principles above discussed are followed.

TABLE III

Load Tests 1945-1946

Overhead Banked Transformer Systems

30 Min. Lincoln Demands

Number of Systems Tested	56
Total Number of Transformers	388
Total Connected Kva.	7080
Sum of All Individual Demands	8163
Average Loading All Transformers	115%
Maximum % Loading	139%
Minimum % Loading	85%
Largest System....13 Transformers	255 Kva.
Smallest System.... 3 Transformers	10 Kva.

TABLE II

Summary of Failures on Banked Transformer Systems

1934-1945

Year	Feeder	Size of System No.	Size of System Kva.	Trans. B. O. No.	Trans. B. O. Size	Cause	Results
1934	204	3	40	1	15	Lightning	Line junction fuses blew
	3307	5	80	1	25	Lightning	Remaining transformers blew fuses
1935	1815	4	90	1	25	Unknown	Cut clear—no outage
1942	1815	8	125	1	25	Lightning	Cut clear—no outage
1943	1001	5	105	2	25	Lightning	Apparently one 25 kva. failed due to lightning. Crew servicing did not clear trouble properly resulting in 3 other failures later that night. Also poor system design.
1945	3006	5	95	1	25	Overload	Cut clear—no outage—Some oil boiled over.
	2403	11	150	1	10	Unknown	Cut clear—no outage

Half-SOLD is *Half*-LIGHTED

N. H. BOYNTON, *General Sales Manager, General Electric Co., Nela Park, Cleveland, Ohio*

Knowledge, effort, and time must go into the selling of commercial lighting if customer is to get most benefit from it; if maker and seller of equipment, contractor, and utility are to realize on its business potential

THE OLD SAYING that "half a loaf is better than none" cannot be safely applied to modern lighting. Not only the customer, but the utility, the contractor, the salesman, the lamp and fixture manufacturer, everybody involved inevitably suffers in any compromise with good lighting standards. A really good lighting installation doesn't just happen. It has to be planned and each of the specific functions the new installation is designed to serve must be integrated in the layout. Otherwise the job falls short of its goal; or additional planning, material and labor must be expended.

A Los Angeles case history well illustrates the point. Within a short period of time, three separate jobs were designed for the same store, all of which, with foresight and careful planning, finally were completed in a single operation.

A. F. Gentry, manager of Leed's Shoe Store, was enjoying a good business, and he decided that a modern fluorescent lighting installation would make it better. After a good general lighting job was completed, customers commented favorably on the change and sales volume improved. The new lighting was good, but not for long. The manager gradually realized that he also needed auxiliary lighting of higher intensities right on the merchandise itself. So, supplementary down-lights were installed. Again, sales records improved. The lighting was better, but still not good enough to satisfy the now light-conscious John Gentry. For a third time he went into a huddle with his contractor, and they completed the job with a third installation that supplied dramatic display illumination.

Everybody Loses by Underselling

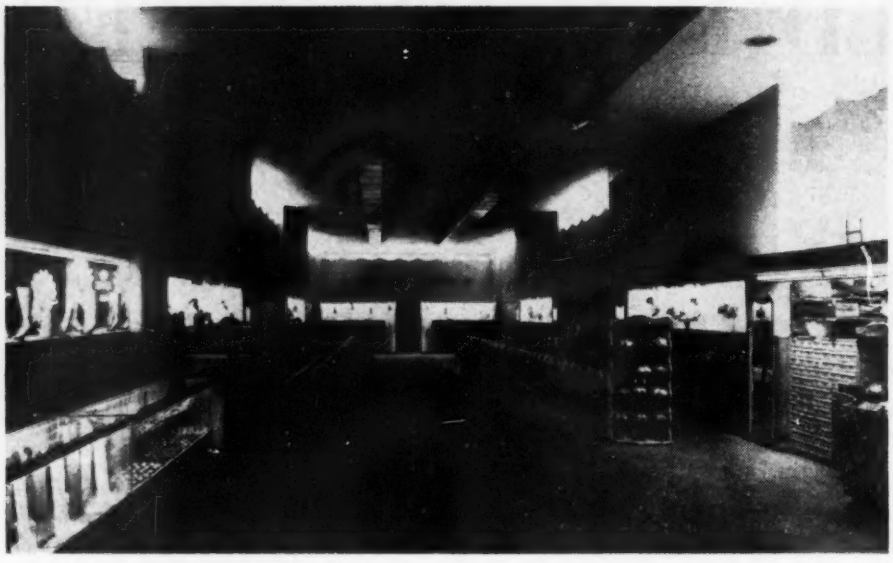
In all cases of undersold lighting, utility men, and representatives of every other group in the lighting industry know that it is not correct to say that all's well that ends well. It is well that Leed's Los Angeles store eventually benefited from a complete and profitable lighting installation. But even this happy ending is not satisfactory to anyone in the lighting industry when we consider the loss in kilowatt-hours, time, energy and profits that might have been avoided had the three sales and installations been completed at one time.

Moreover, in a costly percentage of all cases where a partial lighting job is sold, its inadequacies are not so easily or quickly corrected. Too often, they continue to stand for a long time, as evidence of the very human tendency to let well enough alone, as a poor advertisement for modern commercial lighting. In terms of actual loss to the lighting industry, these half-lighted stores present an even more depressing picture. The utility loses in kilowatt-hours, the contractor in labor, and the lamp and equipment manufacturers in sales. The Lighting Equipment Committee of the Lamp Department of the General Electric Co. has done extensive research to determine the actual dollar loss to various groups in the industry that results from underselling. In the case of a store of average size, the detailed loss figures as follows:

Cost of an Underlighted Store

	PER STORE
Loss to contractor (labor only for hanging six fixtures)	$18.00
Loss in fixture sales	198.00
Loss in lamp sales	23.75
Loss to utility (annually)	171.00
Total loss to lighting industry	$410.75

IN THE LEEDS Los Angeles Shoe Store, three separate techniques were developed before modern lighting was fully employed. This view (left) shows the effect of 50 footcandles of general illumination only. (Right)—Here, 330-watt reflector down-lights provide highlights on leather, supplement over-all illumination and raise levels to 70 footcandles



COVE ILLUMINATION for atmosphere and local case lighting for attraction are shown in this picture of auxiliary lighting with ceiling illumination off

This dollar loss is in itself serious enough, but even more serious is the loss in good will, the loss of faith on the part of disappointed retailers who have been sold an inadequate lighting installation. These merchants believed that lighting would do something for their business. As a result of indifferent, incompetent, or too hurried selling methods, every group in the lighting industry suffers a dollar loss that can be definitely estimated. Neither can the loss in good will be measured, and in some cases that loss may even prejudice customers against modern lighting for years to come.

It is easy for the optimist to say, "I really don't know of very many such cases of undersold stores in our territory." It is natural that some utility and lighting men should think of underselling as the exception rather than the rule.

Well documented figures from a number of nation-wide studies of early fluorescent installations do not warrant such optimism. In the columns of ELECTRICAL WORLD, and in the "Nation-wide Survey of Fluorescent Lighting in Stores," published by the Lamp Department of the General Electric Co., there has been revealed a widespread tendency to compromise on the kind of relighting jobs that fall far short of the customer's requirements. The prevalence of underselling, with its threat to every group in the lighting industry, must be kept constantly before us if we are to make the most of the opportunities we face today.

It must be remembered that of the considerable number of retail stores that bought fluorescent lighting just before the war, 55 percent of them bought on a current-saving basis. Only 27 percent of the stores that installed new lighting received advice from their utility representatives. It is significant that in cases where utility advice was not solicited, kilowatt-hours decreased; when utility advice was received, kilowatt-hours increased. Although only one out of four stores consulted with utility men before making their initial fluorescent installations, three out of four store owners said that they would welcome this service in their future lighting problems.

Early Buyers Undersold

In the opinion of the interviewers, including many utility representatives, more than 81 percent of these early buyers of fluorescent were undersold. Only 42 percent used a planned layout, and 46 percent replaced fixture for fixture. In a store where fluorescent fixtures are used merely to replace filament lamp fixtures, the retailer does not get the benefit of modern sales lighting, distributors and contractors lose business, and the utility suffers an average loss of 25 percent in kilowatt-hours.

We know that the reason many early fluorescent customers failed to use this new light source as its manufacturers and the utilities expected is because this new lamp developed in public favor too rapidly for our educational and promotional machinery to keep pace. As we examine the commercial fluorescent market of today, we find in it some of the same factors that operated to the detriment of high lighting standards in the early days of fluorescent lighting.

When demand gets too far ahead of supply, many salesmen find themselves following the lines of least resistance. A complete lighting job is more difficult to sell, takes more time to plan, than a quick change from filament to fluorescent general lighting. With eight out of ten retail stores anxious to relight, utility representatives, contractors and lighting salesmen will do well to guard consciously against the natural tendency to hurry along to other waiting customers when a prospect wants to compromise on something less than a complete lighting installation.

To those who will advise with store owners and managers on their relighting problems and install and sell the lamps and fixtures, it may be of value to point out three basic requirements of every complete relighting job. The effectiveness of a sales lighting installation can be measured by these yardsticks. A complete lighting job must contribute to atmosphere, stimulate attraction, facilitate appraisal. The three A's of modern lighting are basic.

Lighting Builds Atmosphere

No single factor contributes more to atmosphere than planned lighting. As a customer enters the door, or pauses on the street before an all glass front, the interior atmosphere registers a point. It is natural that the customer should expect the good taste expressed in interior decoration to extend to the merchandise on the shelves. The alert lighting consultant will recommend an over-all lighting pattern that complements every other interior appointment, provides ample general illumination, and helps create an atmosphere that is conducive to comfortable buying of merchandise.

Lighting for attraction is also basic to a planned sales installation. The contractor or salesman who sells modern lighting, rather than lamps and fixtures, will consider on every job the possibilities of using light as an attraction factor. He will plan different lighting intensities for different merchandising areas, different kinds as well as different quantities of light for a variety of merchandising jobs. Whether for windows, or interior dis-

plays, the ratio between stepped-up footcandles and increased attraction is the same. The alert lighting man will consider the many locations that retail stores offer for using fixtures that combine filament and fluorescent light sources. These and other modern applications of new lighting tools offer new opportunity to enhance the attraction of merchandise with modern sales illumination.

Appraisal Lighting

Appraisal is the final step in many sales. Whether employed in show case, niche or island display, appraisal lighting has an essential job to do in every store in making it easy, almost automatic, for prospective customers to judge style, quality and value. For this particular job supplementary lighting units will be needed. The commercial lighting counselor who fails to recommend the use of ample supplementary units for appraisal has missed a vital opportunity for sales and service.

If fluorescent is to perform maximum service to the customer, it must be sold, not only as a replacement for filament in general installation, but also as a merchandising aid to bring new atmosphere, attraction and appraisal to the retailer and his customers.

If fluorescent is to serve the utility as an increasingly valuable load builder, it must be sold by men who strive to make every installation a model demonstration of modern lighting at its best. Few commercial jobs can be completely effective without supplementary filament lighting for display emphasis.

Load Potential Revealed

The value to the utility of complete sales lighting installations is illustrated by the accompanying figures, giving connected wattage and estimated kw.-hr. for the Leed's Shoe Store that was referred to earlier.

These figures for a single store indicate the load-building potential of sales lighting when its installation conforms to modern standards. Anything less than a complete commercial job means lost business for the merchant and every group in the lighting industry.

In any territory, in which a constructive, continuing program is organized under utility leadership, it can

THE INSTALLATION is complete only when all elements are integrated to achieve a high quality of modern sales lighting. Total connected wattage of 22,170 indicates the load-building potential of a complete commercial installation which conforms to modern standards

be said that kilowatt-hours for store lighting will be far greater in 1950 than they were in 1940.

With such a commercial load potential at stake, the utility can ill afford to do anything less than an aggressive and thorough job of promoting retail sales lighting. Electrical wholesalers, contractors and other groups in the lighting industry will expect the utilities to lead the way in promotional and educational effort. Building contractors and architects will look to the utilities for information on the new tools and techniques of lighting and their adaptation to plans for remodeling and new construction. Merchants, too, will need frequent guidance from utility representatives in their choice of lamps and fixtures.

	CONNECTED WATTAGE (including ballasts)	ESTIMATED KW.-HR. PER YEAR
General Lighting:		
Fluorescent	8,790	27,000
Filament	9,000	26,000
Supplementary Display and atmosphere	4,380	14,000
TOTAL	22,170	67,000

Dominant utility leadership will invite representatives of the electrical, building and retail fields, to cooperate in meetings for group discussion and demonstration of lighting equipment. Those who will sell, buy, and plan the varied uses of modern lighting tools cannot help but do a more complete job if they are kept fully informed on the requirements to which approved lighting installations must conform.

Further to assure correct and profitable commercial lighting standards, utility executives will give careful attention to the hiring, training and directing of a lighting sales force. A complete utility lighting campaign will also make full use of display rooms for demonstration of all types of equipment, showing lamps and luminaires in use in approved installations. Any educational and promotional campaign to raise commercial lighting standards would be incomplete without an adequate advertising program to prepare merchants for a broader use of modern lighting for better selling.

Up to this time we have done a lot of thinking, surveying, planning. As we see it, the time for action has arrived. For the attainment of lighting levels that will truly advertise fluorescent at its best, for the full use of the new lighting tools to serve completely the needs of our commercial customers, for the interests of every group that has a part in the supply, sales and service of modern lighting, let us resolve to see that our products and service are fully sold to the customer and correctly installed.

INSULATION TESTS *of Induction Regulators**

JOHN C. PARKER, *Supervisor, Kenatron Test Dept., Memphis Light Gas & Water Division*

Intermittently used units found with high power factor—Drying out recommended when value reaches 10 percent—Enhanced ventilation to prolong oil life—Results prompt annual dielectric tests

FOR SEVERAL YEARS we have been curious about the condition of insulation in the 158 single-phase, 2,400-volt, indoor type induction regulators on our system. Prior to the investigation described herein the extent of our knowledge of these induction regulators was the following:

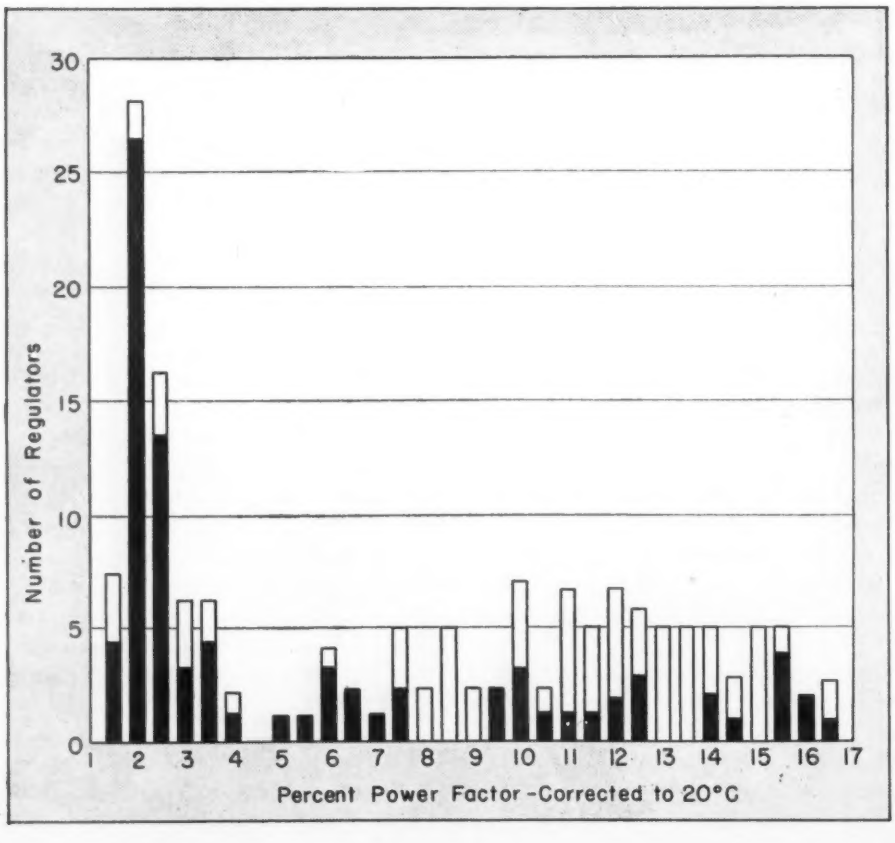
1. The dielectric strength of their oil was held above 20 kv. by periodic oil tests and, when necessary, filtering or replacing the oil.

2. Oil in the older regulators was sludging badly.

3. Occasionally a regulator failed in service.

On several occasions we discussed the possibility of determining regulator insulation condition, by some type of test, with the manufacturers that supplied the regulators. They attempted to discourage any form of test, except a test of the dielectric strength of oil samples taken from the regulators.

FIG. 1—Power factor of regulator windings. Solid areas represent regulators less than 8 years old, open areas ages from 10 to 25 years



Disregarding the manufacturers' negative reactions to regulator insulation tests, we have in the past year attempted to determine the condition of insulation in all regulators on our system. This investigation consisted of measuring the power factor of the winding insulation in each regulator with either a Doble Type I or Type M 2,500-volt tester and making interfacial tension, acidity and dielectric break tests on an oil sample from each regulator. Results of the winding power-factor and acidity tests are indicated in Figs. 1 and 2. The dielectric strength of each oil sample was over 20 kv.

Identical Results

The Doble Type I-25 set was used to test 30 regulators and a Doble Type M 2,500-volt tester was used to test 128. Tests with the Type I set were made at 5 kv. There was no practical difference in test results obtained with these sets. Results of tests on the winding insulation of, and oil samples from, regulators over ten years old were about what we expected. Although we do not have inspection, maintenance or service records, we know that most of them have been loaded to capacity for at least half of the time they have been in service.

The winding insulation power factors of all regulators less than eight years old which have been in constant service were less than 5 percent. The regulators in this group having winding power factors of 10 percent or more are on bus tie circuits and have, therefore, been in actual service less

* *Based on paper presented at the 1946 Doble Client Conference.*

than 15 percent of the time. The high power factor of winding insulation in these regulators is due to moisture. This was definitely proved by drying one regulator in an oven, thereby reducing its winding power factor from 15 percent to 3 percent.

Suggested Procedure

One manufacturer suggested the following procedure for drying regulator insulation: "Excite the regulator from a 230-volt circuit, with the rotor in the neutral position and the series winding short circuited through a current transformer with an ammeter connected. Then rotate the rotor to obtain full load current in the series winding. After operating in this way for two or three days, to drive the moisture out of the winding insulation into the oil, it would be desirable to filter the oil in the regulator, while this excitation and load is being maintained." We have not used this method, since we have an oven suitable for drying regulators.

We have not determined how high the power factor of regulator winding insulation can go before the insulation becomes an operating hazard. However, we believe that drying regulator winding insulation when its power factor exceeds 10 percent would be good insurance against failure if some means can be provided to prevent moisture entering the regulator after it is dried. We do not know how to prevent the accumulation of moisture in the winding insulation of regulators that are used intermittently. The one type of regulator that we have investigated is of such construction that it is not practical to seal it tight enough for dehydrating breathers to be effective. At present we are investigating the possibility of keeping the insulation of these regulators dry by leaving them energized when they are not in service.

Insulating Oil

We were astonished at the high percentage of regulators less than eight years old with bad oil. These regulators have never been loaded to their name plate rating. Their average peak load has been less than 75 percent of their name plate rating, with a load factor of less than 60 percent. The ambient temperature in the rooms in which they are installed has never exceeded 30 deg. C. The maximum temperatures measured on the outside of their tanks just above the radiators were 60 deg. C., plus or minus 5.

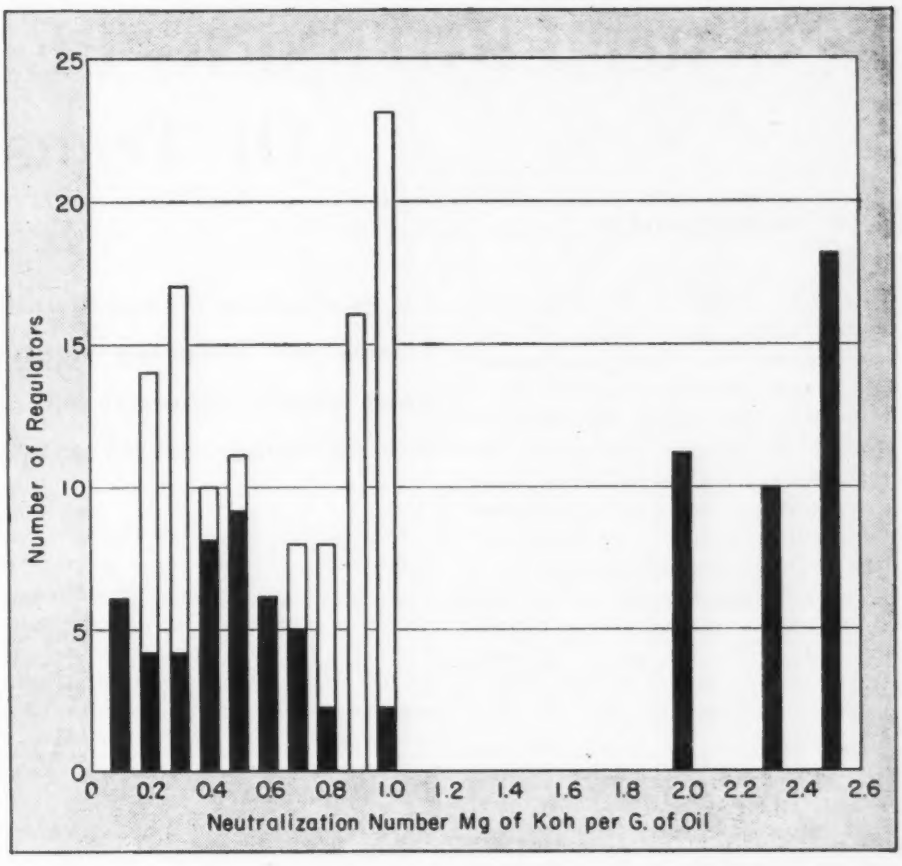


FIG. 2—Acidity of regulator oil. Solid areas represent ages less than 8 years, open areas represents ages from 10 to 25 years

One manufacturer suggested that the useful life of regulator oil could be increased by improving regulator ventilation, thus reducing oil temperatures. Each of the regulators less than eight years old is installed in a compartment of a metal-clad enclosure that matches the metal-clad switchgear in our substations. The metal-clad enclosures were designed and manufactured by the regulator manufacturer. These enclosures are installed on the first floors of our substations with the bottom of each regulator compartment opening into the basement. This opening is obstructed only by two I-beams that support the regulator, and the regulator itself. The top of each regulator compartment had 16 sq. in. of grilled openings for ventilation. After making the tests described herein we increased the size of the grilled openings in the top of each regulator compartment to 600 sq. in. This reduced the temperatures, measured on the outside of regulator tanks just above the radiators, approximately 10 deg. C., and should increase oil life.

The manufacturer of regulators with oil having a neutralization number of 2 mg/KOH or more has advised us that the high acidity of oil in these regulators is due to the varnish used on the windings. He also advised that the acidity of the oil would not deteriorate the winding insulation since it was due to varnish. We have been unable to determine whether this is correct or not. It has been definitely established that organic acid in oil, due either to oxidation or to contamination with varnish and other foreign matter, will deteriorate cellulose insulation. Organic acids with a low molecular weight cause much faster deterioration of cellulose insulation than those with a high molecular weight. This may be the basis for the manufacturer's statement quoted above. To avoid future troubles of this kind we are specifying that oil-soluble materials shall not be used in any oil-filled equipment.

The results of the investigation of our regulator insulation with the Doble sets and by oil tests have been quite satisfactory. We therefore plan to make these tests annually in the future.

Better LIGHTNING PERFORMANCE Of Transmission Lines

T. W. SCHROEDER*, *Electrical Engineer, The United Light & Power Service Co., Davenport, Iowa*

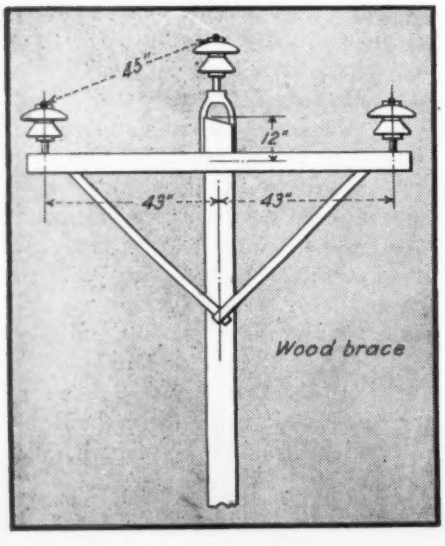
An evaluation of applicability of several accepted techniques for reducing lightning outages of transmission lines under different conditions. Procedure for estimating outage performance of lines is outlined

GROWING LOADS in rural and smaller urban communities are demanding service continuity comparable with those in larger load centers. Thus, it becomes increasingly important to provide low outage performance on the transmission lines serving these loads; a circumstance that calls for improving existing lines and building new lines for fewer and shorter outages.

Lower voltage lines—13.8, 34.5, and 69 kv.—serving such loads are generally subject to the same lightning strokes as their higher voltage, better-insulated companions. Yet, because they must pick up small loads in extensive areas, economics dictate smaller, lower-insulated structures. Thus such lines have one "strike" against them from the start in showing good outage performance.

The solution to the problem on these lines as well as on higher voltage lines is, in part, a more generous design of structure. With this may be used overhead ground wires, ground-fault neutralizers, expulsion protector tubes and automatic reclosing line circuit breakers; either separately or in combination.

FIG. 1—This 34.5-kv. structure design frequently used in rural areas has an estimated line-to-line flashover value of about 625 kv.



Steel towers were originally used for important high-voltage lines because of their greater durability. While they are more expensive than wood pole structures they do permit the use of longer spans. Wood pole structures have since come into use even on lines of voltage as high as 230 kv. Wood pole structures permit the smaller number of insulators per string for the same impulse strength.

Although the impulse strength of wood structures may be relied on as resistant to flashovers from lightning surges, wood permits high power frequency leakage current to flow hence sufficient insulator strength against normal and transient dynamic voltage is required. It is good practice to use, as a minimum, insulators of sufficient 60-cycle strength to withstand switching surge overvoltages, which have been measured as high as 5.5 times normal line to neutral voltage crest. For a 69-kv. line the 60-cycle flashover strength of the insulator would thus be 220-kv. rms.

Impulse strength of wood structures may be made use of in a coordinated line design. Through such design the point of flashover can be controlled by providing the lowest impulse strength at a definite point on the structure. In the "H" frame structure of Fig. 2 this point should be the airgap path "A" between phase conductor and pole downlead. It is best to avoid wood in the flashover path but if, because there is no insulator swing the path is over B and C (Fig. 2), it is desirable to have a fairly large area of contact between the insulator fixture and the crossarm to avoid crossarm shattering due to impulse current concentration at this particular juncture.

To prevent crossarm shattering, the downlead connection (shown by dotted line) has been used in some instances to increase the flashover strength along wood above the air-gap strength.

Considerable study has been made of the impulse strength of various types of wood poles and crossarms in series with pin and suspension type insulators. A conservative value is 50 kv. per foot wet and 100 kv. per foot dry.

Overhead Ground Wires

The overhead ground wire form of lightning protection is in general highly effective in preventing line outages. Essential to such effectiveness are low footing resistance of shield-wire ground connections and ample spacing between shield wire and phase conductors.

Modern line design practice usually employs a "cone of protection" angle ("P", Fig. 2) of about 30 deg. Objects within this angle generally will not be struck by lightning; hence practically all strokes will contact the shield wire. As the vertical distance between ground wire and conductor increases, however, the phase conductor becomes subject to "side flash." It may be desirable on higher voltage lines to modify the structure design so as to move the ground wires outward horizontally toward the outside phase conductors from one to three feet.

Properly applied a ground fault neutralizer or Petersen coil provides a resonant grounded system. While this does not prevent faults, it does reduce the power follow current in a transitory single-line-to-ground fault to such a low value that the arc will not be sustained, thus reducing outages due to faults of the line-to-ground variety. The neutralizer does not prevent

* Based on a paper presented before the Seventeenth Annual Engineer-Conference of the Missouri Valley Electric Assn., Kansas City, April 10-12, 1946.

outages due to faults of other types. Although it has been applied to systems of practically all voltage classes 13.2 kv. and up, the coil has found its greatest usefulness on existing lines from 23 to 69 kv.

Extensive, lightly loaded systems in sparsely settled areas with many miles of line per circuit breaker have in the past operated ungrounded to permit continuity of operation with one conductor grounded. However, ungrounded operation of extensive systems gives rise to high transient voltages which often cause damage to the system. System grounding by means of ground fault neutralizer serves the dual purpose of reducing transient voltages and improving outage performance on such systems.

The ground fault neutralizer cannot give the best account of itself where there are no downleads on wood pole lines, where steel crossarm braces are used, or where downlead grounding resistances are high. Without downleads the line-to-ground insulation strength is greater than the line-to-line insulation strength except at guyed structures. Thus, a large proportion of the lightning strokes will cause line-to-line flashover, rendering the neutralizer ineffective except for those line-to-ground flashovers at guyed structures.

Effect of Steel Braces

Steel crossarm braces on structures like Fig. 1 provide such a low insulation strength phase-to-phase that a high proportion of the flashovers occur line to line. If downleads are employed on these lines a fault starting phase-to-ground may become phase-to-phase if the product of stroke current and high downlead footing resistance cause the structure top to rise to an impulse potential in excess of the insulator strength. This occurs before the neutralizer can clear the original line-to-ground fault.

A suggested type of construction for 33-kv. lines (Fig. 3) adapted to good neutralizer performance features:

(a) Ten-ft. crossarm to provide good phase spacing.

(b) Wood crossarm braces giving maximum structure impulse strength.

(c) Center conductor higher than outer conductors, and gapped to pole downlead. This "coaxes" stroke to center conductor favoring phase-to-ground flashover.

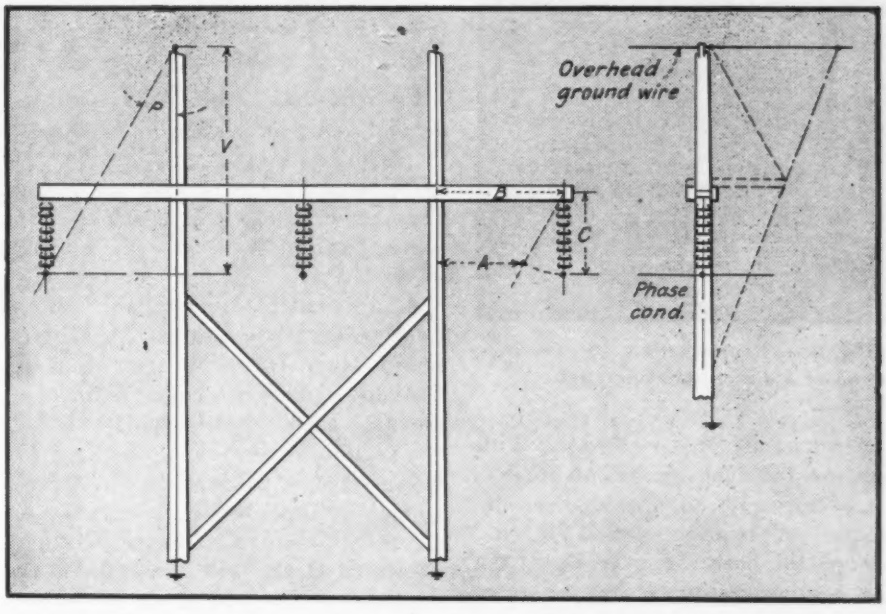


FIG. 2—Typical H-frame structure. With swinging insulator string lowest impulse strength will be arc-gap path "A." With no swing, path may be across string and crossarm to downlead path B and C

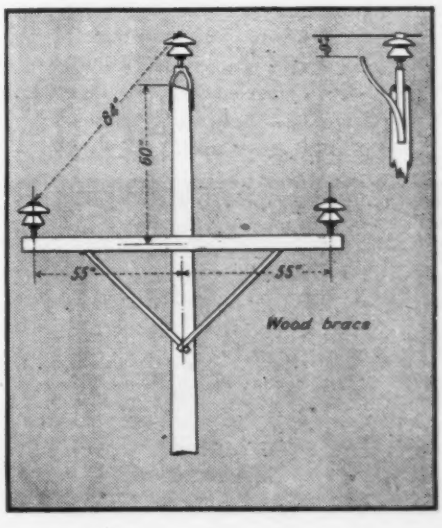
Line performance improvement through automatic reclosing minimizes the effect of flashover by shortening the duration of outages caused by temporary faults. Simultaneous clearing and high-speed reclosing of both ends of a faulted transmission line section through carrier current relaying, is used where system transient stability is a factor. Some use is made of multiple-shot single-end reclosure following an unsuccessful ultra-high speed initial reclosure, but the multiple shot reclosure is used mainly to reclose one end of a faulted loop circuit. A refinement of this is the coordinated use of time-delay, voltage-controlled, motor-operated disconnecting switches for automatically isolating a faulted line section.

Automatic reclosing can be used to advantage on most modern breaker installations. Its use should not promote carelessness in line design to prevent outages, however, nor obviate the use of other forms of line protection herein discussed.

Expulsion protector tubes provide a controlled flashover path by means of a gap enclosed in a treated weatherproof fiber tube. Wall thickness and bore of the tube depend on the range of magnitude of short circuit follow current the tube is required to extinguish subsequent to impulse flashover. Protector tubes have been applied primarily on existing lines built without ground wires or on new lines where their cost was less than that of overhead ground wires plus the cost of securing sufficiently low footing resistance to make ground wire protection effective.

If tubes are to be used effectively in areas where high footing resistances predominate, they should be installed on each phase conductor at every structure. Sometimes tubes are applied only to the top conductor if the structure configuration is such that one conductor is higher than the others. This is done on the basis that most strokes

FIG. 3—Type of 33-kv. structure design adapted to good Petersen coil performance. Note how center conductor is "gapped" to coax stroke to flashover to ground for clearance by the neutralizer



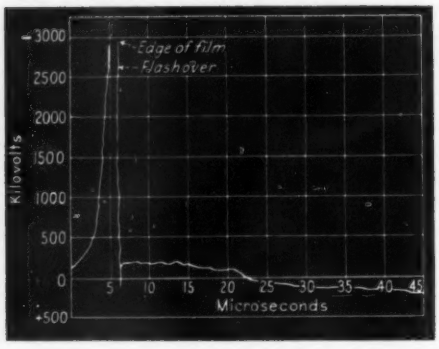


FIG. 4 — Reproduction of oscillogram of a direct lightning stroke

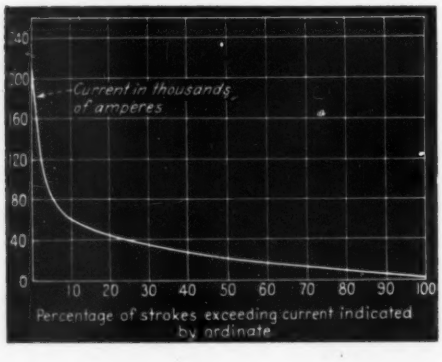
will contact the top conductor. With high resistance in the ground connection of the expulsion tube, however, the product of impulse current flowing through the flashed-over tube and the high footing resistance may raise the structure-top potential to flashover of the untubed phases.

With tubes applied intermittently, that is, with one or more untubed structures between tubed structures, flashover may occur due to strokes near the untubed structure. Reflection of the lightning wave from adjacent flashed-over tubed structures will mitigate this possibility, but such helpful effect decreases as the distance between tubed structures increases and the footing resistance at tubed structures increases.

Any analytical method used to evaluate outage expectancy, being of necessity based on observed field and laboratory data covering the important quantities involved, is subject to inaccuracy because of the possibility of a wide range of variation of these quantities. Important basic quantities are:

1. Probable strokes to line per year.
2. Strokes causing flashovers.
3. Flashovers causing outages.

FIG. 5—Expectancy curve for lightning stroke currents reveals that 25 percent of all lightning strokes exceed 40,000 crest amp.



4. Magnitude of stroke current.
5. Rate of rise of stroke current.
6. Footing resistances to surges.

Each of these will be discussed in detail briefly, in relation to their uses in performance estimates.

Probable Strokes to Line per Year: The number of times direct strokes will contact a line in a year is subject to wide yearly variation. Average figures are available but probably better information for local areas can be obtained from U. S. Weather Bureau Stations. In performance estimates, the use of 100 strokes per 100 miles per year in an isoceraunic level of 35 is suggested, with values in direct proportion for other levels.

Strokes Causing Flashovers: Whether or not a stroke will cause flashover depends on the magnitude of stroke current, rates of rise of stroke current, footing resistance and midspan clearance of conductors on lines with shield wires, and structure impulse strength.

Flashovers Causing Outages: The number of flashovers of a line which will cause power short circuit current to flow continuously across the path started by the flashover, thus resulting in a line outage, are also subject to considerable variation. Ratios of flashovers to outages of 1.5 have been given for 230-kv. steel tower lines, and a ratio of 1.25 has been used for 115 kv. Factors influencing this ratio are the line voltage (amount of primary insulation), length of lines (the longer the line the lower the voltage recovery rate of system voltage resulting in reduced arc restriking tendencies) and the character of the flashover path. When its path is across wood, the arc may extinguish more readily than when it is across the porcelain of insulators. Thus it is possible that on the lower voltage wood pole lines without ground wires or downleads, the ratio of flashovers to outages may be 1.75 or 2.0.

Magnitude of Stroke Currents: Many measurements of lightning current magnitudes have been made, but stroke voltages have not yet been measured: only the voltages appearing on ground wires and conductors of lines have submitted to the surge voltage recorder and oscillograph. Lightning voltages appearing on lines are limited by the line flashover level itself, hence the voltage information so far obtained has been useful primarily from a wave-shape standpoint. Because of attenuation effects, this wave shape at the measuring point is in general different than it was at the point of stroke contact. Only once so far have engineers been fortunate enough to get an oscillographic record of the voltage of a direct stroke. See Fig. 4.

Performance analysis may be made on the basis of known lightning current magnitude expectancies, which are given in Fig. 5. This curve summarizes the results of 734 records and shows the percentage of this number of strokes which exceed given crest ampere values.

Rate of Rise of Stroke Voltage: The time rate of rise of lightning voltage is like other quantities variable over a wide range. Fig. 4 shows, and other evidence corroborates, that on lines without ground wires the voltage rises at first slowly and later very rapidly. Up to three microseconds (750 kv.) the rate of rise of voltage is 250 kv. per microsecond, following which it rises at the rate of 1,000 kv. per microsecond. Thus, except for lines having low structure insulation level, the higher rates of rise should be used in calculations requiring this factor.

Oscillographic data from various points along stricken lines indicate that lightning voltages at point of stroke contact reach their crest in from 1 to 10 microseconds, with a mean value of 4 microseconds.

Structure Footing Surge Resistance: It has been found that for most soils the footing resistance as measured with small currents can be much less under heavy impulse current conditions, the ratio of d.c. or 60-cycle resistance to surge resistance being as high as 25 to 1, for sand clay soils. It is likely that this ratio is materially less for soils where the measured footing resistances are low, and also it is probably somewhat less for soils in which rock and dry sand predominate.

Outage Expectancy Estimates: In these calculations it is necessary in general to select an assumed value of rate of rise of stroke voltage and structure footing resistance. Then, knowing the line flashover characteristics, taking into account coupling between conductors, it is possible to calculate the percentage of strokes causing flashover. Multiplying the percentage of strokes causing flashover by the number of probable strokes to the line per year and dividing by ratio of flashovers to outages will give the estimated outages per year for that line.

SOUTHWARK STATION
Aimed to be Simple and Reliable.... III

L. R. GATY* *and* E. B. SHEW†, *Philadelphia Electric Co.*

Switchhouse mechanically ventilated with conditioned air—Zoned differential bus relaying—Three-phase 100,000-kva. transformers—Turbo-generators (4 kv.) for auxiliary power with back-up transformers

ON THE PHILADELPHIA ELECTRIC system the necessary neutral grounding is accomplished by grounding the neutral point of generators (all of which are wye-connected) through a resistor in order to limit the current in a phase to ground fault to relatively low value. At Southwark[1], only the generator on the low pressure element of each unit will be so connected. The low tension side of the 13.8-69-kv. transformers are delta-connected, requiring grounding transformers which will be installed in two of the three transformers. The neutral of these transformers is also connected to ground through the station resistor which has a value of 2 ohms and will limit the current in a phase-to-ground fault to approximately 4,000 amp. This value provides sufficient current for protective relay purposes.

Ventilation

The wall space usually used for windows can be used advantageously for equipment locations and, serving no useful purpose, windows were eliminated from the switchhouse. Since there are no windows in the switchhouse, heat loss from reactors, buses, breakers, etc. must be carried from the rooms by mechanical means. Review of the problem indicated that the ventilation system should be capable of dissipating heat at the rate of 2,000 kw.

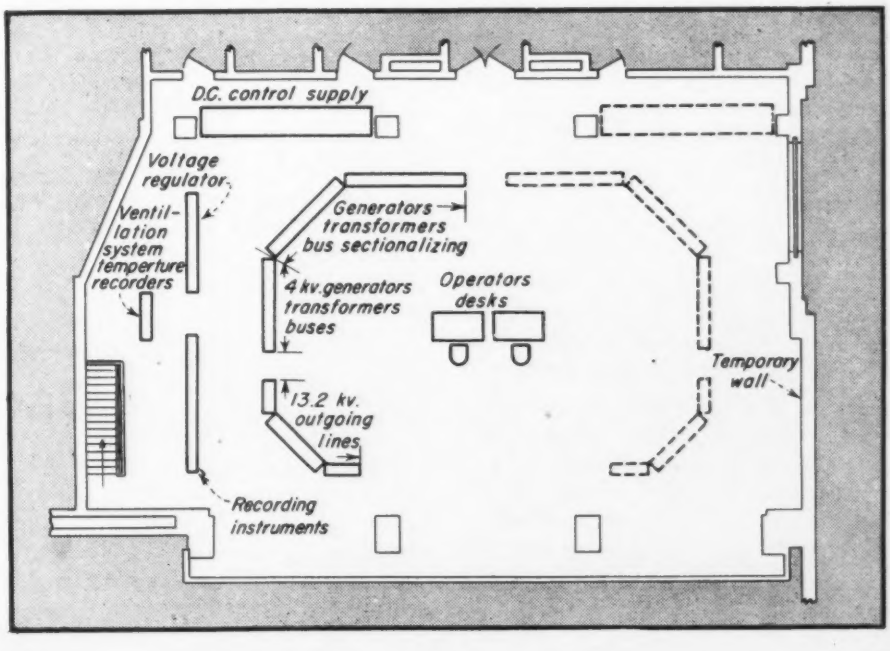
Cooling of the incoming air was found to be the most economical method of maintaining the desired ambient temperatures in the equipment rooms; in addition, filtered air is desirable and temperature of the supply air will be controlled to eliminate the possibility of condensation. The equipment to accomplish this will be located in penthouses on the switchhouse roof with individual ducts carrying the air into the rooms associated with each main bus section to prevent undesirable communication of smoke or gases.

Main Control Facilities

The main control room is located at the center of the ultimate building, 16 ft. above the turbine hall operating level. It is considered desirable for the switchboard operators to be able to see into the turbine hall from the main control room so the wall toward turbine hall will be clear glass and will project into the hall about 4 ft. Otherwise the room is windowless and will be artificially cooled and well lighted.

The switchboards are of the self-supporting, cabinet type with vertical steel panels finished in a light gray color. Instruments are generally 4-in. square type and control switches are rotary type. A mimic bus shows the major connections of the station. For configuration of boards see Fig. 5. All panels are vertical with control switches in a zone from 2 ft. 6 in. to 5 ft. 6 in. above the floor; indicating instruments occupy the upper portion.

FIG. 5—All switchboards in main control room are dead-front type. Stairway at left provides access to wire termination room directly below and through this room to the relay corridor. Control room is adjacent to turbine hall



* Electrical Engineer.
† Engineer of Inside Plant.
[1] Preceding installments appeared in the June 22, 1946, and July 6, 1946, issues of ELECTRICAL WORLD.

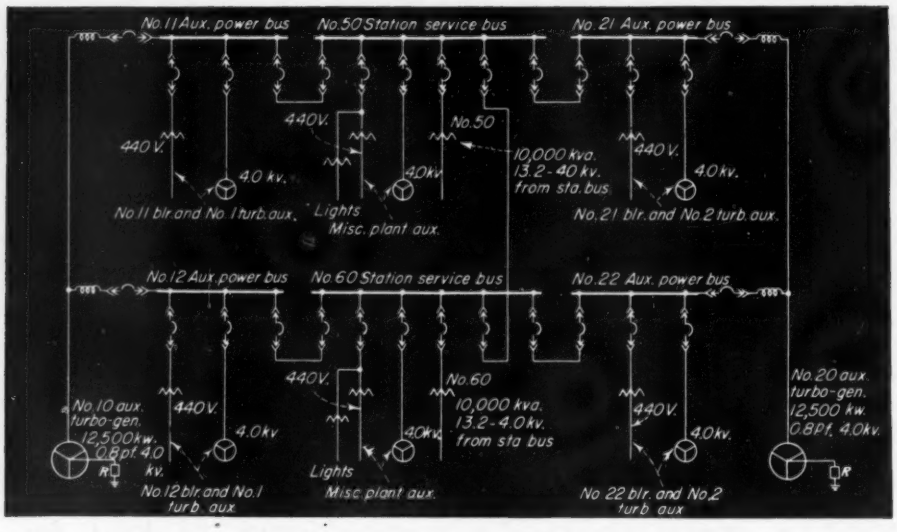


FIG. 6—Major schematic connections of auxiliary power supply

Controls of the major equipment (generators, 13.8-69-kv. transformers and bus sectionalizing breakers) are at the center with the auxiliary turbo-generator controls adjacent. The outgoing line controls are on separate panels toward the turbine hall side of the room. Recording instruments, voltage regulator equipment and d.c. control supply are on boards in the rear of the main boards.

All of the protective relays are in a longitudinal corridor on the floor below the control room with direct access by a stairway. This will permit testing of relays without interfering with normal activities in the main control room.

Protective Relay Scheme

The relay protection for the 13.8-kv. equipment at the new station incorporates two salient features: (1) Rapid operation on buses, generators and main transformers and (2) back-up relays independent of the first line of defense. Differential type of protection is used for the major equipment, and in general, back-up protection is provided by low energy over-current relays.

The differentially protected zone for each main section of the bus extends to current transformers below the reactors on each circuit and to the far sides of the sectionalizing breakers nearest that bus section. Each of the four bus sectionalizing equipments has a separate differential scheme which includes the two breakers involved so that a fault in this equipment will not trip off more than one of the main bus sections.

The two generators of each unit are covered by one set of differential relays which will trip both 13.8-kv. breakers, main and starting exciter breakers and the ground breaker.

The 66-kv. underground cables will be protected by phase-comparison pilot-wire relays and the 13.8-kv. lines by phase and ground overcurrent relays.

Main Units

Each main generator will have a nominal rating of 150,000 kw., 187,500 kva., 0.8 p.f., 13.8 kv., 3 phase, 60 cycle, and will consist of two hydrogen-cooled generators driven by a cross compound steam turbine. One generator is rated 81,250 kva. driven at 3,600 rpm. by the high-pressure element and the other generator is rated 106,250 kva. driven at 1,800 rpm. by the low-pressure element. It is necessary that the armatures of the two generators be solidly connected together electrically and operated as a single unit to facilitate starting and operation of the cross compound turbine. The unit will be operated normally at 168,750 kw., 187,500 kva., 0.9 p.f. with $\frac{1}{2}$-psi. hydrogen.

Each generator will have a direct-drive shaft-end exciter and pilot exciter with automatic voltage regulator. This is to permit independent control of power factor on the high- and low-pressure elements necessary to secure maximum output under varying loads and special conditions, such as with a cooler section out of service on either generator. A motor-driven exciter is also provided to furnish excitation for starting, because field current is necessary in both machines before turning over, and for use as a spare exciter to take the place of either shaft-end exciter.

13.8-69-Kv. Transformers

The transformers have a continuous nominal rating of 100,000 kva. with a 4-hr. rating of 120,000 kva. This matches the rating of the associated 69-kv. underground cables and was selected to permit operation of the plant at full capacity even when locally distributed loads are at minimum values during night and week-end periods.

Economic studies of the cost of three single-phase transformers versus three-phase transformers indicated that the latter would result in a considerable saving in capital expenditure. This is a consequence of 60 percent in ground area and approximately 20 percent less total weight for three-phase transformers as compared to three single-phase transformers of the same capacity. The three-phase construction and three features incorporated in the design, i.e., hypersil iron, forced oil cooling, and form fitting tank, account for the savings. Each three-phase transformer weighs approximately 250,000 lb. and contains 7,100 gal. of oil. The transformers have been designed so that shipment can be made almost completely assembled with a minimum of erection required at the site.

Three transformers will be installed in the initial development and there is space in the yard for the addition of a fourth transformer if required in the future. Space is also provided in the yard for 69-kv. switching equipment but none will be installed initially.

Auxiliary Power Supply

Since Southwark Station will be the first steam-electric plant on the Philadelphia Electric Co. system to be equipped only with pulverized coal boilers, it is imperative that the electrical supply to the boiler and turbine auxiliaries be of the highest order of reliability. Several methods of supply were considered in the planning stages of the project, including (1) shaft-end generators, (2) transformers connected at the generator terminals, (3) complete supply from the main station buses through transformers and (4) a separate turbo-generator for the essential auxiliaries for each unit. The

latter method was found to be most suitable. The first two schemes fall short of the desired goal of reliability for Southwark Station, particularly from the viewpoints of main generator outages and disturbances on the system.

Each auxiliary generator will be rated 12,500 kw., 15,625 kva., 0.8 p.f., 4,160 volts, 3 phase, 60 cycle, and will be driven at 3,600 rpm. by a steam turbine; the generator is air-cooled with a closed system and surface coolers. Each machine is equipped with a direct-drive shaft-end exciter and pilot exciter, and provided with an automatic voltage regulator designed to minimize voltage disturbance with full-voltage starting of induction motors up to 2,000 hp. although the largest motor used in the initial installation is 1,500 hp.

Auxiliary Transformers

In order to provide an alternate source of supply in the event of an outage of an auxiliary turbo-generator, two 10,000-kva., 13.8-4.16-kv. transformer banks are provided, each connecting to a separate 4-kv. bus which will supply the miscellaneous station auxiliaries. To make this capacity available during starting periods or outages of the turbo-generator, normally open ties are provided to supply essential auxiliaries on the individual boiler buses from these buses (Fig. 6). The 10,000-kva. transformers are of the air-cooled design and will carry the normal miscellaneous station auxiliary load of 2,500 kva. (approximately one-half on each bank).

Auxiliaries for each boiler are supplied from a separate 4-kv. bus with the turbine auxiliaries for each unit divided between them. These, together with the two station service buses, make a total of six in the initial development of the plant. The same degree of isolation is provided here as in the switchhouse with each 4-kv. bus and associated breakers in a separate room. In no case is there direct access between rooms, corridors being provided for this purpose.

Choice of Voltage

The selection of 4,000 volts for the primary supply of auxiliary power was brought about by the large loads involved in the plant, for example, the 10,000-kva. transformers at 2,400 volts would require current-carrying capacities of approximately 2,400 amp. whereas at 4,160 volts the total current will be in the order of 1,400 amp. This permits the use of standard air circuit breakers of 2,000-amp. current rating without the necessity of operating two breakers in parallel. The economics also indicated that copper requirements at the higher voltage would result in considerable saving. Another advantage of the higher voltage system is in the lower voltage drops involved in connection with full voltage starting of the motors.

In selecting the voltage for the smaller auxiliaries, consideration was given to 220, 440 and 550 volts. At the lower voltage, breakers having an interrupting capacity of 50,000 amp. would be required whereas with either of the two higher voltages 25,000-amp. interrupting capacity would be sufficient so that this consideration, together with a saving in copper, led to the selection of one of the higher voltages. A survey indicated that 440-volt equipment is likely to be more nearly standard among the suppliers than 550 volts and thus the 440-volt, three-phase system was selected. Supply to the 440-volt equipment is through air-cooled 750- or 500-kva., 4160-480-volt, delta-delta three-phase unit substations located in the switchhouse, heater bay and coal tower.

Motor Voltages

Motors of 200 hp. and higher are supplied at 4,000 volts and below this size are in general supplied at 440 volts. Consideration was given to raising the dividing point from 200 hp. to 300 hp. but there are only a few between these two limits (chiefly the pulverizing mill motors) and since a high degree of reliability is required for these motors it is undesirable to supply them from the 440-volt system because of the introduction of additional transformers in the supply.

For combustion control and certain other important devices, 110-volt supplies are provided by transformers fed from the 440-volt system. In order to provide a high degree of reliability for combustion control and certain other important control devices involved in the boiler auxiliaries, a voltage throw-over scheme is used in the low voltage supply between the auxiliaries of the two boilers which make up one unit. For example, the control devices for No. 11 boiler will be supplied normally from No. 11 boiler auxiliary bus but in the event of the deenergizing of this bus for any reason the supply is automatically thrown over to No. 12 boiler auxiliary bus. These are the only automatic throw-over schemes used in the supply of boiler auxiliaries.

Control Power Supply

To provide a reliable source for the control of circuit breakers, rheostats and other devices, two 480-ampere-hour (8-hour rate) 250-volt storage batteries are installed in separate rooms in the switchhouse. These are charged by motor generator sets located in another room. The batteries will carry the emergency lights, strategically spotted about the plant, for ½ hour in the event of the loss of the normal source. Emergency lights are on separate circuits and are thrown over automatically on the loss of the a.c. supply. The leads from the batteries are connected to a double sectionalized bus located in the main control room from which emanate main and emergency control feeds to the four 13.8-kv. sections in the switchhouse, to the auxiliary power rooms above the heater bay and to various other points about the plant where direct current control service is required.

Telephone service to the plant is provided mainly from the company PBX and from the load dispatcher's office. A plant PBX will be located on the ground floor of the administration building adjacent to the plant offices. There will be a telephone operator in attendance during the day hours but at other times selected telephones will be operated through a box type PBX in the main control room. The principal communication within the plant will be supplied by a public address system with microphones and loud speakers at strategic locations. This will permit the transmission of messages from the main control room to the boiler room or turbine hall and to other operating points so that all of the plant force will be apprized of instructions necessary in the operation of the plant. This system can also be used for paging men who may be called to the telephone while in the plant.

The design drafting and purchasing has been handled entirely by the Philadelphia Electric Co. with the United Engineers and Constructors, Inc., as construction agent.

EDITORIALS

S. B. WILLIAMS, *Editor*

The Second Half of the Year

EVEN with the increased prices already received, either directly or as the result of decontrol, many electrical manufacturers will have to decide probably before the end of the year between "holding the line" to help keep down inflation and keeping their business in a reasonably healthy financial condition. So far the manufacturers have exercised commendable restraint, but unless there can be some way of checking rising cost there must eventually be some relief through higher prices.

Not many manufacturers will openly admit this dilemma at this time, so eager are they to remove any reason for a continuance of price control and government regulation even though the facts seem to show that without price control prices would increase less than the amount for which a case can be made out. Nothing like the flood of increases have been announced since July 1 as came in the closing month of OPA.

Better manufacturing and material supply conditions in the second half, as is generally expected, should be reflected to some degree in production costs, but employment statistics all seem to point to an extremely acute labor shortage. This, some believe, might be expected to put a ceiling on production not very much in excess of what it now is, which again would delay the day when production passed incoming orders and competition took a hand in prices.

A plentiful supply in raw materials, particularly copper, on the other hand, can do a powerful lot to increase production of a wide variety of electrical products and when that happens we will have our real test of production versus incoming orders. Several manufacturers see the balance as changing in the next few months. Once it starts and buyers find they no longer have to stand in line it can change very fast.

There is every reason to have confidence in a large market for some time, but the sooner it becomes a buyers' market the better off everybody will be. Strangely enough there is no incentive in a sellers' market, except for those who want to get rich fast and get out.

For the balance of the year certainly we may expect to continue in a sellers' market, at least as far as electrical products are concerned. In that time some upward price revisions can be expected but long before that we expect more than one manufacturer to get the signal that the day of change is not far off—the day when customers once more can be urged to buy.

There Can Always Be Cooperation at the Local Level

ON several occasions we have urged cooperation between the utility industry and REA and we still believe it can be done at the local level. Nationally, however, Administrator Wickard has said publicly that he will not engage in any cooperative program with the utilities. He was asked by the American Farm Bureau Federation to participate in a cooperative program of farm electrification but he refused because the utilities were participating. The utilities offered to cooperate in the allocation of territory on an area basis, in order to speed up the work without further bickering, but again he refused.

With the job of line extension so near completion—another three years or less should complete it—it is too bad that the utilities and REA can not get together on the important job of putting electricity to work. There should be no such controversy over that phase of the operation as over lines where territory was at stake. The fact that Mr. Wickard has refused to cooperate, however, should not deter the utilities from working with the co-ops in their areas. While REA could and did exercise certain control over line construction because it was financed with loans, there is and can be no control over load-building activities.

Mr. Wickard accuses the private utilities of being interested in profit, but at the same time he is conscious of the fact that co-ops will not pay off their loans unless they have better loads and load diversity. The co-ops and the utilities have exactly the same interest. Neither want these lines to be operated at a loss. And they don't need to be operated at a loss in most sections of the country if they have the right load. In more densely populated rural areas it is possible to secure rural line income in excess of $150 per mile at city rates. In thin areas, that will be possible only with much larger usage.

The power companies not only have a background for helping the farmer increase usage of electricity, but they have the personnel. They should share these with their co-ops, because every load added to one of these lines means more wholesale kilowatt-hours, and probably better diversity and load factor.

From this point on the utilities should have but one program for the farmer, and that is to show him how to get the most out of his electric service, regardless of who serves him. There can always be cooperation at the local level even when it gets stuffy at top.

Must Prove Need for New Power Plants

WHILE there is no indication of a general denial by the Civilian Production Administration of power plant construction applications under the Veteran's Housing Program, utilities no longer may expect approval merely by asking for it. If the project is necessary and will cause hardship if delayed there is every reason to believe it will not be held up, but it will be up to the utility to furnish the evidence to prove its case.

At the present there probably are not more than half a dozen power plant applications pending with CPA, and there is no reason to believe that any of these will be denied. They may, however, have to present further information before getting approval.

Before the utility section of CPA will be able to make recommendations in the future it will have to have full information on present load and load growth estimate, capacity, interconnections, reserves and such other information as will show the necessity for the addition at the time wanted. This should cause the utilities no great amount of trouble because major system additions are not started until the engineering and system planning departments have demonstrated the need to management in a far more detailed fashion than will ever be required by CPA.

Ever since the housing program went into effect in March the number of approvals of non-housing construction have exceeded the denials and while field offices, where the smaller projects are approved; have been asked to be much more strict, all evidence so far points to a policy of doing nothing that will be harmful to the future economy of an area or a business. Up to the present, power plants have had no difficulty going through, but recently the housing administration raised the question of necessity based largely on testimony last fall of the former head of OWU before the Senate Appropriations Committee on the deficiency bill. In the last three-quarters of a year, however, the power outlook has changed materially. Many utilities had expected considerable time to elapse before the hole left by loss of war business would be filled, only to find that civilian production load was returning at a faster pace. Since the war monthly non-coincident peak data has not been compiled, but if it were it would not be surprising if current peaks were found to be exceeding those of the similar time last year. This is borne out by the weekly output statistics coupled with the general report that load factor is off considerably. At the beginning of the year the weekly output was 13.2 percent below last year; at the end of the first half it was only 5.1 percent behind.

In fact, this country is probably nearer to a power shortage now than at any time during the war, and will be that way until it gets the relief from the new capacity on order. The picture is somewhat clouded by the national statistics which include areas of very large war supply and which currently have a large surplus. However, the fact remains that in a great many instances power company managements are worried about finding time for overhaul. Reserves were cut pretty fine during the war, but machines were run harder and longer.

Also, a lot of old equipment was pressed into regular service, equipment that was expensive to operate. Much of it should be retired and not be required to stand the expense of overhaul.

Under these circumstances power systems should have little difficulty proving necessity for new plants, but from now on they will find that their applications will go through much more smoothly and with minimum delay if they are fully documented with facts that will permit CPA to substantiate the need.

Local Councils Planting Seeds of Engineering Unity

THERE is a lot of talk today about bringing the many engineering societies together in a unified national body for purposes of advancing professional development. How it can be done, what type of organization may evolve—in fact, why it should be done at all—are questions that are being discussed. Meanwhile, local sections in forty or more cities are plotting the course that may prove to be a practical pattern for national unification.

Interest in plans and operations of local councils of engineers, subject of a special conference session during the recent A.I.E.E. summer convention, could easily lead to the optimistic conclusion that such an over-all national association might follow. While many of the organizations are in committee meeting stages only and all of the councils have a limited scope in their activities, it was apparent as one after another of the local section representatives told of the meetings and publications in their cities, that electricals, mechanicals, civils and all the other specialized societies of engineers have reasons and methods for some joint actions.

Perhaps the key to the success of many of these local councils is the simplicity of organization and singleness of purpose that has drawn the local sections officers together. Planning a few joint meetings, publishing a local meeting notice paper and sponsoring an occasional civic projects committee are not spectacular evidences of a unified professional organization; but they are seeds. As so ably stated by President Wickenden, national unity on a plane above specialization can follow only after these seeds of local unity are well cultivated and fertilized.

No conclusions or further plans were drawn at the conference, but three observations might be noted. First, there is no one pattern of organization that stands out as more practical than others—local conditions and objectives govern the plans. Second, it is not probable that national unity will be achieved through bringing all of the local councils together in one grand council; that must come through an action of the national societies. Third, the councils are successful because they are serving individual members of the member societies.

WASHINGTON COMMENT

By R. N. LARKIN Washington Correspondent

Wickard on the War Path

IF one's decision were based upon utterances of Rural Electrification Administrator Claude R. Wickard, it would be difficult to conclude that REA co-ops and privately owned utilities are not mortal and unreconcilable enemies.

Wickard, who was once accused by a few co-op people of being entirely too pro-private power, recently loosed two more blasts.

One of these was a communication to land-grant colleges, the other a speech before a Texas statewide co-op meeting. In both, as in earlier blasts, Wickard viewed with considerable alarm what he described as a "revival of propaganda promotional projects reminiscent of the twenties."

Views With Alarm

"Friends of rural electrification," Wickard asserted in his statement to the colleges, "will recognize in the present power company proposals a strong resemblance to the program of the late twenties conducted on a broad front and supported by an ample treasury, supplied, of course, by the power company consumers. That program, sponsored by the National Electric Light Association, known as NELA, subsidized college professors, 'inspired' textbook and newspaper publishers and writers, reached practically from the kindergarten to the rarer atmosphere of the university laboratory all to exalt the electric industry. The exposure by the Federal Trade Commission of the shocking machinations of this group brought about a hiatus in this program. NELA died unmourned. But from its ashes arose E.E.I. to carry on modestly and quietly for a while, at least until recently, when, stimulated by the bolder and more venturesome enterprises of the most recently conceived Council of Electric Operating Companies and National Association of Electric Companies, it cast aside its reserve and joined the revival of propaganda promotional projects reminiscent of the twenties."

Wickard has been complaining for some time about the research grants to colleges and feelers thrust out to farm organizations by the industry. Undoubtedly he will continue to do so. Such activity impinges on undertakings described in REA's latest annual report, for 1945, page 12, under the heading "Working With Educators."

Points With Pride

"Continued shortage of manpower and materials for the manufacture of electrical equipment for use on the farm and in the farm home precluded an extensive REA program aiding borrowers and their consumers in utilization of electric service. However, the groundwork for a broad post-war program in this field was laid in educational studies and contacts.

"Publishers, particularly in the textbook field, were interested in receiving material on rural electrification and its socio-economic impact on the nation. Articles, background material, and photographs were prepared at the request of educational publishers. The American Education Press published a noteworthy feature on rural electrification for its grade-school readers.

"Visits were paid to eight state departments of education and twelve state teachers colleges for the purpose of exchanging knowledge on the position of rural electrification in teaching curricula at the various levels. Rural electrification as a field of study was discussed at three college workshops on rural education in which a representative of REA participated by invitation. These workshops were held at the Universities of Virginia and North Carolina and Peabody College in Tennessee. Actual training instruction was given vocational teachers in Kentucky by the Kentucky State Department of Agriculture in collaboration with REA borrowers in Kentucky and with help from REA. Material covered included the fundamentals of house wiring, farmstead lighting, installation of water-pressure and sewage systems on the farm, simple applications of farm electric power, and the social and economic benefits of electricity.

"Several million pamphlets covering utilization of electric equipment and appliances were distributed to rural people through REA borrowers, vocational teachers, and county extension service workers.

"Articles and material were prepared on request for farm and cooperative journals, for the radio, and for the weekly and daily press on many subjects of public interest connected with rural electrification."

The two Wickard documents contain considerable food for thought, however, by no means all of which is so superficial as his concern lest the private power people enter the textbook and education business.

In both documents, Wickard explained his refusal to have any part of the industry's offers of cooperation in finishing the job. In part, his position was based on the assertion that:

"Neither I nor the average board of directors of an REA cooperative would or could justifiably tell farm people that, despite their wishes, they could not cooperatively own and manage their electric facilities, the same as any other essential farm service."

Company or Co-op Service

This assumes that the issue of company or co-op service is a burning one with a lot of farmers, an assumption that probably would be difficult to sustain in view of the wide belief that what the farmer wants is service—now—by whatever source can provide it dependably and at a low cost. Still, Wickard has a point when he says that division of unserved territory would "arbitrarily deprive farm people of the benefits of the REA Act." There is nothing in the REA Act which allows the administrator to pick and choose as to the recipients of federal financing. If there were such authority it is hardly likely that it would be exercised.

If Wickard were solely concerned with seeing rural users get service, by whomsoever rendered, his remarks on the E.E.I. speech by Grover Neff would have at least commented on Neff's endorsement of "area coverage."

NEWS OF THE WEEK

Atomic Pilot Power Plant Scheduled for 1948

Pilot Plant at Oak Ridge to Use Conventional Heat Cycle at Steam Temperature Somewhere Between 650 and 940 deg. F.—Capacity of Plant Not Yet Decided

THE Manhattan District's atomic-electric power plant is about two years away from operation, ELECTRICAL WORLD learned this week from directors of the project which was begun last April at Oak Ridge, Tenn.

"This pilot plant for nuclear power will be pushed to completion as rapidly as possible," Dr. James H. Lum, executive director of Clinton Laboratory at Oak Ridge, asserted. "Numerous experiments must be made before final design can be settled. These experiments will probably consume all of 1946 and part of 1947. The difficulties of procurement of equipment of this special category will probably delay the starting of the final pilot plant until 1948."

Considerable emphasis will be laid, during design and construction of the plant, upon achieving a heat source of long life and great reliability. These attributes are of particular importance because of the radioactivity which renders any pile, once operated, difficult and dangerous to shut down for repair or maintenance. In addition, radioactivity requires heavy shielding of the pile, which also makes it desirable to avoid as greatly as possible any non-operational work on the pile once it has operated.

First operation of the pile will be to derive heat energy for steam-electric generation. The plant is being designed to operate at conventional central station temperature levels. These are regarded by power engineers as ranging from 650 degrees F. to 940 degrees F.

When the problems of harnessing nuclear reactors for steam-electric generation have been solved, it is expected that the project will be broadened to test such additional heat-transfer agents as mercury vapor and various gases. Unconventional heat levels may also be attempted, it was indicated.

Regarding temperatures which may be expected, it was indicated that the only limit on temperatures which will circumscribe the project arise from the ability of the materials used in the pile to withstand heat. It is not anticipated that any limitation will be placed on the design because of fears that too great a temperature might induce unsafe reactions in the fissionable material whence the heat is derived.

Because of the hazards present in the process, it is expected that more than usual use will be made of the "mock-up technique" in producing the atomic pilot plant. Exhaustive tests are scheduled at many stages of the development and on numerous of its aspects. Resulting data will be used in drawing up final specifications.

As yet, no indication may be had of the capacity of the pilot plant. It is expected that all equipment will be relatively conventional from the boiler on through the cycle. None of the major components has yet been ordered. Their production would require a year or more, under normal circumstances.

Included in the group designing the power pile are representatives of the major electrical manufacturers, the Navy, and the Army Air Forces. The latter, in conjunction with aircraft engine companies, are supplying personnel and technical assistance. Engineering and physics departments of various universities and colleges are expected to participate also.

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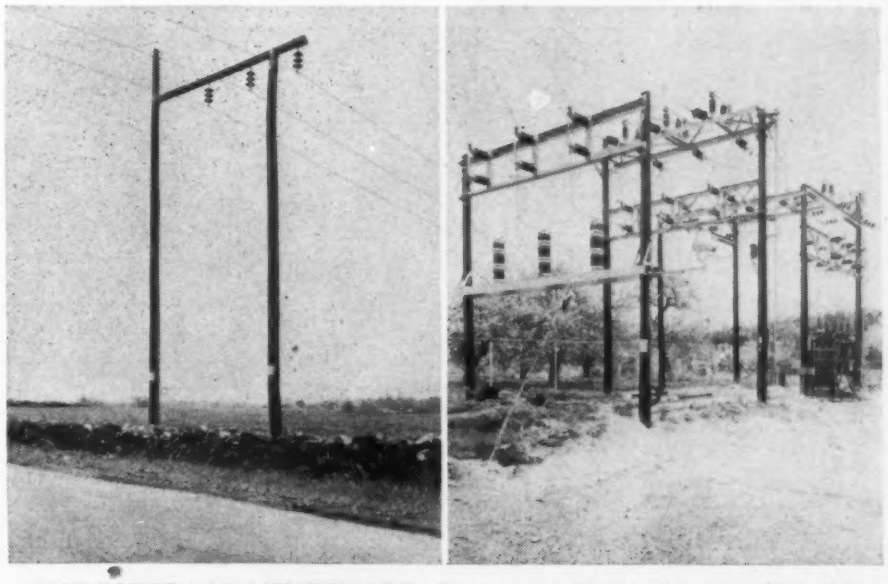
23,000-Kw. Unit Planned

Ohio Edison Co. will spend $2,600,000 to increase the capacity of its Mad River plant by 23,000 kw. to a total capacity of



MORE POWER FOR SOUTHERN R.I.—Narragansett Electric Co., Providence, large New England Power System subsidiary, completes a new 20,000-kva. line to provide more capacity in the Wakefield-Westerly area. From Elmwood substation in Providence 4.75 miles of G.E., 33-kv., gas-filled cable of 3-conductor, 500,000—cir.mil section has been laid to a new terminal structure at Cranston, whence a 33-kv. Polarm type overhead circuit (left) of No. 4/0 bare copper extends 6 miles further to a terminal structure (b), (right) at Drum Rock substation. A right-of-way 125 ft. wide was acquired to enable four overhead circuits to be accommodated in future

81,700 kw. The new unit will be steam driven using coal for fuel. The present building will be extended to house the unit. Construction will begin in 1947, and the unit is to be in operation in 1948.

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Arizona Supreme Court Kills Rate Survey Referendum

An Arizona supreme court decision late in June killed a move to force a referendum at the November election on a $50,000 legislative appropriation for a state-wide survey of power rates, and state officials immediately acted to bring in a Federal Power Commission staff for the study. The investigation was authorized last fall by a special session.

The decision reversed a superior court ruling (ELECTRICAL WORLD, February 9, 1946, page 9) by declaring that the appropriation was for the support and maintenance of a state department, the Arizona Corporation Commission, and was not referrable.

Authorization of the rate survey ended a four-year quest by Gov. Sidney P. Osborn. The act directed the corporation commission to borrow experts from the FPC to help in the probe of state power rates.

Wilmot Trew, who was the plaintiff in the original action, in a lengthy motion for rehearing described the court as "unstable", but Mr. Trew and Henderson Stockton, associated with him in the case, lost their appeal for a rehearing.

Los Angeles Lets Contract for 3 Generating Units

A $2,064,586 contract for three steam generating units for the Los Angeles Harbor power plant was awarded to the Riley Stoker Corp. by the city's Board of Water and Power Commissioners in a further step to forestall a future power shortage in the area. Under present conditions, electric power in the city may not be adequate to meet demands within the next few years.

The boilers, to be the largest units on the Pacific Coast, will supply steam for 100,000-hp. turbines driving three proposed 75,000-kw. electric generators. Contracts for the generators were awarded several weeks ago to the General Electric Co. and Westinghouse Electric Corp. for $3,571,000.

The boilers will occupy a 68 x 46-ft. ground area and be 85 ft. high. They will be able to utilize either oil or gas as fuel.

The installation of the three steam turbine generating units, adding 225,000-kw. capacity to the present plant, is expected to be completed by late 1949. When placed in operation, the three units will augment a 65,000-kw. generator installed June, 1943, and another 65,000-kw. unit now being placed on the line.

The board recently was informed by General Manager Samuel B. Morris and Chief Electrical Engineer Charles P. Garman that an anticipated decrease in power demand after V-J Day did not materialize. Industrial peak demand registered only a slight drop and residential and commercial loads increased sharply and are continuing to rise.

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$1,265,000 Selling Price Placed on Utility Property

If the Benton County Public Utility District takes over the Benton County, Wash., properties of the Pacific Power & Light Co., it must pay $1,265,000, the figure set recently by the jury at the Federal District Court at Yakima, Wash.

Representatives of Burns & McDonnell, Kansas City consulting engineering firm, who testified for the P.U.D. placed a value of $540,000 to $590,000 on the properties. It is not yet decided whether the P.U.D. will be willing to pay the higher price or whether it will give up the idea of making the purchase. The P.U.D. has a reasonable time in which to decide; a reasonable time in such cases is usually one year.

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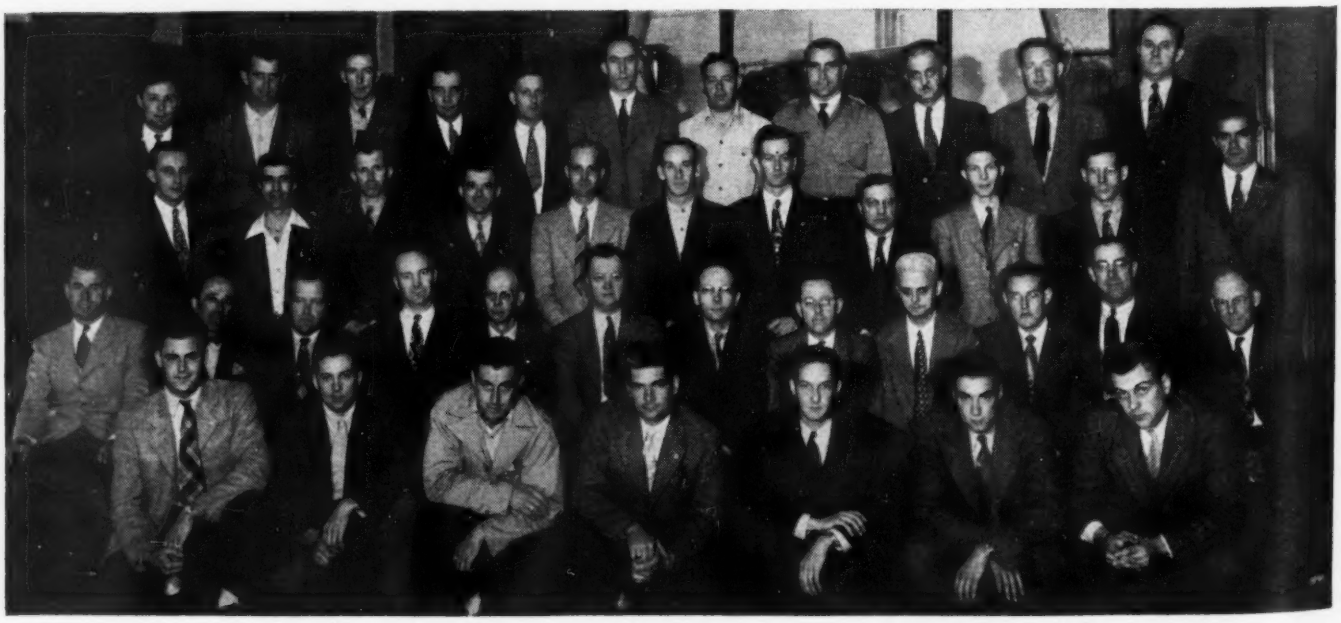
Approve $400,255 Program

Appropriations totaling $400,255 have been approved by the board of directors of the Rochester (N. Y.) Gas & Electric Corp. for installation of new electric and gas facilities throughout the city.



METERING CLASS AT BOSTON—This class of 36 men from eastern and central New England points completed the second course in electric metering techniques, principles of operation, and testing conducted at the Boston Edison Co., June 10-14, under the sponsorship of the New England Association of Meter Engineers. In the second row are the instructors, Frederick Telford, fifth from left, Wentworth Institute; Arthur Russell, Franklin Technical Institute; Ralph Powers, Boston Edison Co., chairman Educational Committee, N.E.A.M.E.; Fred Austin, Public Service Co. of New Hampshire, and R. J. Griffin, Lawrence (Mass.) Gas & Electric Co.

New Budget Standards May Cut Government Power Program

Acting Budget Director Appleby Lays Down Seven Guiding Standards for Federal Agencies — Interior Department Faces Necessity of Legislation for Steam Plant Construction

FEDERAL AGENCIES have been directed to prepare their budgets for the fiscal year beginning next July 1 on the basis of standards which, if literally applied, could reduce substantially the government's power construction program.

Seven standards guiding the preparation of next year's budgets were laid down by Acting Budget Director Paul Appleby on instructions from President Truman. They are the result, Appleby told the chiefs of federal departments, of the President's direction that plans be laid not alone for a balanced federal budget in fiscal 1948, (July 1, 1947-June 30, 1948) but for the accumulation of a "substantial surplus" for national debt reduction.

"On Eve of High Prosperity"

Appleby's letter asserted that Mr. Truman's direction "is based on the view that we are on the eve of a period of high prosperity and substantially full employment," and the letter added:

"In these conditions, sizable debt reduction is nothing short of obligatory budget policy. Merely to balance the budget is not enough.

"To achieve the President's objective, strict economy must be exercised in the government expenditure programs and high taxes must be retained."

Appleby dictated these standards for budget preparation:

1. Requirements for existing activities should be carefully reviewed to eliminate work of low priority and to provide for more efficient performance of necessary work. . . "

2. Estimates should not contemplate expansion in activities, either by increases in existing activities or initiation of new ones, unless such expansion is required to meet a demonstrable public need of the highest priority, cannot be deferred, and cannot be avoided by more efficient and economical administration.

3. Consideration will not be given to estimates for new activities for which no basis exists in legislation.

4. Estimates for authorized civilian public construction and improvement programs should be limited to those for which the public need is so great, both from the standpoint of economic return and social benefit, that it is not in the national interest to postpone them. All other projects, especially those which would impede the flow of materials and manpower to the emergency housing program, should be deferred until a later year. Consideration will be given to estimates for planning and investigations of authorized public works projects for future initiation.

5. Construction for national defense purposes should be deferred in all cases where national security would not be impaired.

6. Necessary supplies and equipment should be acquired to the fullest extent possible from surplus stocks of the government.

7. A specific instruction as to the price assumptions that should be made will be issued when final Congressional action on the Price Control Act is known.

While the Appleby program is one which obviously will have greater or lesser effects, depending upon the degree to which it is enforced and the willingness of Congressional groups to abide reductions in or delays to their pet programs, at least one immediate effect on the government's electric power program is foreseeable.

The Interior Department faces the necessity of obtaining enactment of a law authorizing the construction of steam-electric plants in conjunction with federal hydro systems whose output it markets. Under point 3 of the Appleby standards, such authorization will have to be obtained before any estimates for such steam-electric capacity can be considered in Interior's fiscal 1948 appropriation bill. During debate on the 1947 Interior Appropriation Bill it was agreed by all concerned that, except for specific projects, no such authorization exists today.

LONG SERVICE APPRECIATION— James R. Lyons (left) receives a 50-year service pin at the hands of W. W. Broadbent superintendent of production, southern division, New England Power System, in honor of Mr. Lyons' electrical supervisory record at the South Street generating station of Narragansett Electric Co., Providence

•

Court Overrules FPC Motion on Conowingo Power Case

The Third U. S. Circuit Court of Appeals in Philadelphia has overruled a motion by the Federal Power Commission for dismissal of the appeals taken last October by the Philadelphia Electric Power Co. and the Susquehanna Power Co., owners of the Conowingo hydroelectric project on the Susquehanna River, from two commission orders fixing the "actual legitimate original cost" of the project at $49,047,699.

The two companies, subsidiaries of Philadelphia Electric Co., claimed they actually spent $54,866,625 in the construction of the project. Their appeals are for the reinstatement by the commission of costs of $4,389,818, both being willing to drop further contests on items totaling $1,429,107.

FPC sought dismissal of the appeals on the technical ground the two power companies had not complied with the procedural steps of the Power Act. The Court of Appeals, however, sustains the companies' right to have their appeals heard, although no date has been set for the hearing of the merits of the case.

•

Commission Permits Co-op to Buy Private Utility

Purchase by the White Mountain Electric Cooperative, Inc., of the Lakeside Light & Power Co. at Lakeside, has been formally approved by the Arizona Corporation Commission.

Present owner of the utility is the Valley National Bank, as executor of the estate of Herbert D. Lore, deceased, and Ross A. Fish. The commission order set forth that the offer made by the newly organized cooperative "is reasonable" and that the transaction is "in the public interest."

The White Mountain Cooperative plans

to borrow money from the Rural Electrification Administration to rehabilitate the Lakeside power and light system and to expand it to serve not only that community but others near by, including Pinetop.

•

Illinois Power Asks End of Power Sales Contract

Illinois Power Co. has asked the Securities and Exchange Commission to give its approval to the company's proposal to cancel and terminate a contract for power between the applicant and Union Electric Power Co. of Missouri. Both companies are units in North American Co.'s holding company system.

The original contract, entered into on May 8, 1922, was between Illinois Power's predecessor, Iowa-Illinois Power Co. and Mississippi River Power Co. Illinois Power and Union Electric became parties through a series of assignments. Under the terms of the agreement, Illinois Power purchases electric energy of Union Electric at a point near Hamilton, Hancock County, Ill.

In the proposal to terminate the contract, Illinois Power contended that under the present contract with Union Electric it pays $260,000 annually for 42,000,000 kw.-hr., or at a rate of 62 cents per kilowatt-hour. Illinois Power further stated that this energy can be generated in its own new plant at Havana, Ill., at an annual cost of $131,000, or at the rate of 31 cents per kilowatt-hour.

Coincident with the proposed termination, Illinois Power would transfer and convey to Union Electric certain utility assets. These include a frequency-change building, a transformer substation, and twenty miles of double-circuit, 69,000-volt, steel tower transmission line.

•

Electric Operating Revenues Increase 2% in April

Electric operating revenues of the larger privately-owned electric utilities in the United States in April 1946 were $263,178,000, as compared to $257,895,000 in April 1945, an increase of 2.0 percent, according to preliminary figures announced today by the Federal Power Commission.

Revenue deductions (including operating expenses, depreciation and taxes) were $198,300,000, a fractional percentage under those of April 1945.

Gross income, including other utility operating income, increased 10.5 percent to $74,864,000 and net income in April 1946 was $53,130,000, an increase of 32.8 percent from the net for April 1945.

Northwest Utilities Merger Explained by Presidents

The proposed consolidation of the Pacific Power & Light Co. and Northwestern Electric Co. is the culmination of months-long studies of plans to strengthen and streamline their financial structure, according to Paul B. McKee and L. T. Merwin, presidents of the respective companies.

A statement issued at Portland by the heads of the two companies said that as soon as final details have been perfected, plans for the merger will be presented to the stockholders of the two corporations and to state and federal regulatory authorities having jurisdiction.

"Success of the reorganization program will mean a constructive step forward in the direction of even more rapid electrical progress in an area already enjoying rates that are the lowest in the nation," they said.

In Philadelphia, the American Power & Light Co. of New York asked the Securities and Exchange commission to authorize the private sale of a 6 percent note of its subsidiary, Pacific Power & Light, to non-affiliated interests to provide funds for the reorganization program. The note has a balance due of $1,794,500.

Opposition to the merger is expected from Interstate Electric, Inc., representing public utility districts in the two states. The non-profit corporation was formed late last year to acquire Oregon and Washington properties of the P. P. & L. However, a recent $34,400,000 bid is reportedly not receiving serious consideration by the New York parent company, American Power & Light.

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Kentucky Utility Workers Strike; Gas Plant Closed

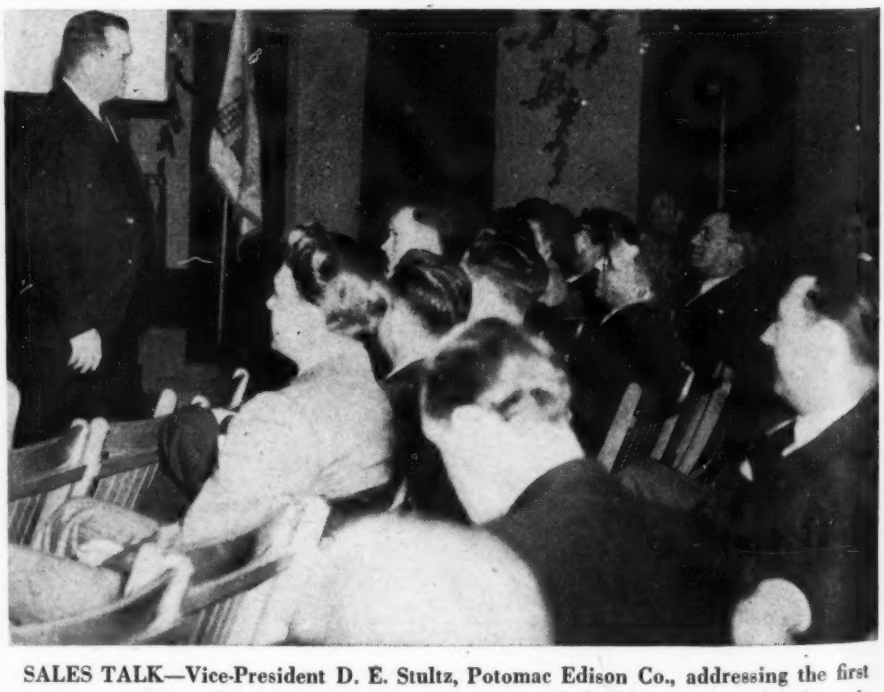
One hundred eight out of 322 eligible employees located in two of the four operating divisions of Kentucky Utilities Co. went out on strike July 8. The company has a total of 1,196 employees. Normal service is being furnished all customers in affected areas with the exception of the manufactured gas plant at Danville, serving 850 customers, which is shut down.

A conference late last week failed to accomplish any satisfactory progress towards a settlement. Some men have returned to work since the strike was first called.

•

C.I.O. Utility Election Ordered

National Labor Relations Board has ordered an election within thirty days of July 2 in which system dispatchers in the central load dispatching office of Pacific Gas & Electric Co. will vote for or against representation of the Utility Workers' Union of America, C.I.O.



SALES TALK—Vice-President D. E. Stultz, Potomac Edison Co., addressing the first post-war meeting of merchandise sales organization. Rebuilding of the sales force is now underway in preparation of a planned load-building campaign which will expand as appliances and equipment become available

Group to Study Power Plant Issue vs. Housing Program

Formation of Committee by CPA Follows Attempts to Restrict Construction of Power Plants

The Civilian Production Administration has organized a committee to study the relation of power plant construction to the emergency housing program.

The group was organized after attempts were made by leaders of the housing program to restrict power plant construction as being unnecessary and in conflict with the housing program. Paul B. Valle, who handles utility affairs for CPA Administrator John D. Small, is a member.

It was reported that representatives of Housing Expediter Wilson Wyatt moved in on the construction of power houses on the basis that they are not needed and are depriving the housing program of materials which could be used better in residential construction.

Exemption of $15,000 Allowed

It was explained that, because of administrative provisions governing the processing of applications for construction priorities, very few if any applications for authorization to construct hydroelectric power houses are handled in Washington, whereas many applications for steam-electric plant construction are handled in Washington. Thus, the matter so far concerns steam-electric power house construction only.

CPA's order governing construction allows an exemption of $15,000 for utility structures, and no application need be submitted for structures which cost less than this amount. Transmission lines and utility facilities which do not include buildings are not included under the requirement that authorization be obtained from CPA before construction.

It was anticipated that the attempt to defer or halt power plant construction would not result in any blanket order or policy against such construction. It was felt, however, that approval of such projects henceforth will be forthcoming only when substantial supporting data is produced to demonstrate the necessity for construction of the facilities applied for.

Only a few power plants are now held up pending final determination of the problem, it was learned. Among them are plants at Sewaren, N. J., a plant in Pennsylvania, another planned by the Central Illinois Public Service Co., and a fourth by Consumers Power Co.

Meanwhile the Civilian Production Administration denied a War Department request that they be authorized to assign preference ratings for materials used in its rivers and harbors and flood control projects. The department has authority to assign preference ratings for important military construction, but even this may be curtailed, the CPA statement indicated.

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Two Cities Favor Municipal Plants; One Rejects Plan

At a recent special election voters of Cairo, Ill., voted 1,345 to 656 in favor of a proposal that the municipality purchase the local electric and gas facilities of the Illinois Power Co. for $1,760,000.

Voters of Bowling Green, Mo., at a special election held on July 9 authorized the city to issue $175,000 in bonds to finance a municipal light and power plant and distribution system. The vote was 570 to 327. Under the terms of the bond issue the city is authorized either to purchase the present facilities of the Missouri Edison Co., which now supplies electricity to the city, or to build, maintain and operate an entirely new municipal power plant and distribution system.

The official count of the special election held in Norborne, Mo., July 2 on a proposal for the city to issue $65,000 in bonds to finance construction of a municipal electric distribution system, shows that the project failed of passage. The vote was 269 for the bond issue and 312 against. If the bond issue had passed, the city planned to seek to purchase the existing distribution system of Missouri Gas & Electric Service Co. If the offer was rejected the system would have been constructed and power purchased wholesale from the municipal plant at Carrollton.

•

Utility Pays Water Bill

Niagara Falls Power Co. has paid the state of New York $2,299,999.97 covering the balance of arrears due from July 1, 1943 to June 30, 1946, for use of water diverted from the Niagara River for generating electric power. The payment is in accordance with an agreement signed in April (ELECTRICAL WORLD, April 27, page 71) providing for an annual rental payment of $1,100,000 for a 12 year period.

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Arkansas Co-op Moving

Woodruff Cooperative Electric Corp. will move its headquarters from Augusta to the suburbs of Forrest City, Ark. The co-op has purchased a two-acre site about a mile north of the city, and construction of an office and warehouse building has begun.

Permit Municipal to Connect Lines With Private Utility

Wisconsin Commission Sanctions Tie-In with Wisconsin Gas & Electric after Plant Breakdown

Authorization to the City of Hartford, Wis., to connect its municipal electric lines to the Wisconsin Gas & Electric Co. for an indefinite period, because of a breakdown of the Hartford plant, has been given by the state Public Service Commission.

George P. Steinmetz, commission engineer, stated that a boiler of the plant "went out" on July 6 because of a burst tube and made the plant unable to supply sufficient energy for industrial use and street lighting. Another boiler of the plant went out of service two weeks before, Mr. Steinmetz said, leaving only one boiler, smallest of the three in the plant, in service.

Wisconsin Gas Notified

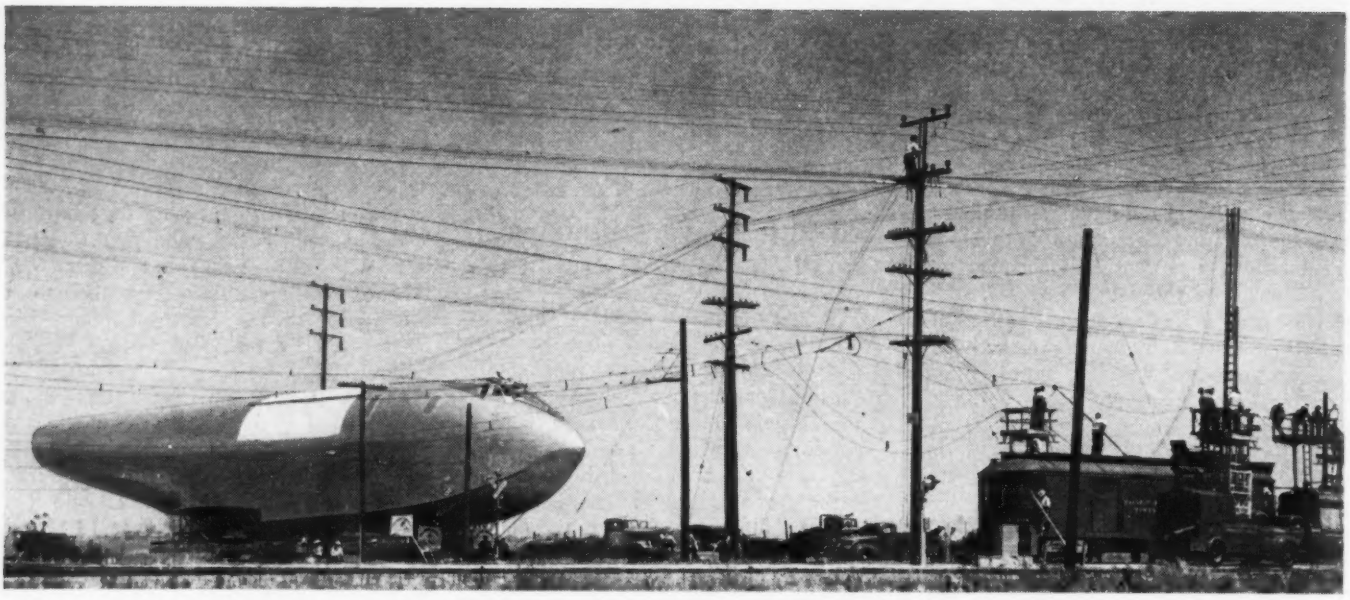
In a telegram to Mayor Osborne of Hartford, following an inspection by commission engineers, the commission said:

"This is in response to your request for recommendation by the commission as to the advisable course of action by the city as a result of power difficulties. In view of the power difficulties experienced, as disclosed by our inspection and considering the delays in delivery of equipment and materials being experienced not only by the city of Hartford but by all other utilities, the commission recommends that the city enter into a contract with the Wisconsin Gas & Electric Co. to furnish power in an amount to insure adequate service. Such contract should be drawn subject to the approval of the commission."

A letter was also sent by the commission to Wisconsin Gas, confirming a recommendation of the PSC engineering staff that an emergency connection be made to the Wisconsin Gas lines to furnish service to the city.

Meanwhile, the resignation of Frank Bryant, who became city engineer May 15, was accepted unanimously by the council. He said the position required that he "get an almost impossible job done." His makes the third resignation within a year.

The recurring trouble of the utility caused the defeat of Mayor Adam Polti by Osborne, the resignation of City Engineer Jess B. Johnson and hearings before the Public Service Commission. The commission last October held that the city's power plant was giving inadequate service. It ordered the city to provide additional power within 30 days. In November, the commission gave the city



NEXT TRIP IT WILL GO OVER THE WIRES—Lines of three utilities are being moved during the 28-mile trip of the Howard Hughes flying boat, largest in the world, from Culver City to Long Beach, Calif. The lines being moved here belong to a telephone company, the Pacific Electric Railway, and the Los Angeles Department of Water & Power, only three of the 10 utilities involved in the moving. Some 2,300 wires had to be lifted to give 40-ft. clearance to the 220-ft. fuselage

until January 15 to increase its electricity supply by purchase of a new generating unit. In the fall of 1944, Polti proposed a $300,000 expansion program, and it was approved in a city referendum in the spring of 1945. Polti was opposed to connecting with the private utility's line at an estimated cost of $30,000 during last fall's emergency and he vetoed the common council's approval of the hookup.

•

Court of Appeals Upholds Potomac Rate Cut Order

The United States Court of Appeals has upheld a District of Columbia Public Utilities Commission rate order against the Potomac Electric Power Co., slashing rates by $1,037,000 for 1944.

Activity under Washington's sliding scale formula, in effect since 1925, has been at a standstill since the PUC issued the disputed order on 1944 rates. No action was taken at annual hearings on the 1945 and 1946 rates.

Both Pepco and the Federal Government had assailed the 1944 order, the former asserting that it cut too much from operating revenues, the latter that it cut too little. The U. S. District Court for D. C. had upheld the order, as the Appeals Court did this week by 2-1 decisions, junking both company and government appeals.

If no appeal is taken, the 1944 rate order will become retroactive to March, 1944, yielding residential consumers, who were assigned most of the reduction, bill credits estimated at $2.50 for the average user.

Will Buy Small Local Unit

Ohio Public Utilities Commission has approved the purchase of the Cleveland Light & Power Co.'s utility properties by the Cleveland Electric Illuminating Co. for $250,000. Cleveland Light & Power, which operates on a small scale furnishing electricity and steam in down-town Cleveland, retained real estate, rights-of-way, and other property.

MEETINGS

Previously Listed

Rocky Mountain Electrical League—Annual convention, Stanley Hotel, Estes Park, Colo., September 5-7. R. B. Hubbard, manager, Gas & Electric Bldg., Denver 2, Colo.

Instrument Society of America—National Instrumentation Conference and Exhibit, Wm. Penn Hotel, Pittsburgh, Pa., September 16-20. Richard Rimbach, executive secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

Illuminating Engineering Society—National convention, Chateau Frontenac, Quebec, September 18-21. A. D. Hinckley, executive secretary, 51 Madison Ave., New York 10, N. Y.

International Association of Electrical Inspectors—Northwestern Section, Boise Hotel, Boise, Idaho, September 23-25; W. L. Gaffney, secretary, 402 City Hall, Tacoma 2, Wash. Southwestern Section, Hotel Sacramento, Sacramento, Calif., September 30-October 2; H. L. Gerber, secretary, 205 City Hall, San Francisco, Calif. Southern Section, George Vanderbilt Hotel, Asheville, N. C., October 14-16; A. M. Miller, secretary, 910 W. 30th St., Richmond 24, Va. Western Section, Gibson Hotel, Cincinnati, Ohio, October 21-23; F. H. Moore, secretary 320 N. Meridian St. Indianapolis 9, Ind. Eastern Section, Mark Twain Hotel, Elmira, N. Y., October 28-30; F. N. M. Squires, secretary, 85 John St., New York 7, N. Y.

Indiana Electric Association—French Lick Springs Hotel, French Lick, Ind., September 25-27. E. F. Hauser, secretary, 1414 Circle Tower, Indianapolis, Ind.

Municipal Electric Utilities Association of New York State—Annual conference, Mark Twain Hotel, Elmira, N. Y., September 25-27. T. J. McKee, secretary, 200-212 E. Third St., Jamestown, N. Y.

American Society of Mechanical Engineers—Fall meeting, Statler Hotel, Boston, Mass., September 30-October 2. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Southeastern Electric Exchange—Engineering and Operation Section, Henry Grady Hotel, Atlanta, Ga., October 3-4; Accounting Section, Fort Sumter Hotel, Charleston, S. C., October 17-18. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 1, Ga.

National Electronic Conference—Second annual conference, Edgewater Beach Hotel, Chicago, Ill., October 3-5. E. H. Schulz, secretary, Illinois Institute of Technology, 3300 S. Federal St., Chicago 16, Ill.

Edison Electric Institute—Electrical equipment committee, New Ocean House, Swampscott, Mass., October 4-5; transmission and distribution committee, Cavalier Hotel, Virginia Beach, Va., October 7-8. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

National Electrical Contractors Association—Annual meeting, Ritz Carlton Hotel, Atlantic City, N. J., October 14-18. C. J. Harder, national secretary, 633 Investment Bldg., Washington 5, D. C.

Electrochemical Society—Fall meeting, Royal York Hotel, Toronto, Canada, October 16-19. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

Pennnsylvania Electric Association—Electrical equipment committee, Lord Baltimore Hotel, Baltimore, Md., October 24-25; B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia 5, Pa.

American Welding Society—Annual meeting, New York, N. Y., October 24, and Atlantic City, N. J., November 17-22. M. M. Kelly, secretary, 33 W. 39th St., New York 18, N. Y.

National Electrical Manufacturers Association—Annual meeting, Traymore Hotel, Atlantic City, N. J., October 28-November 1. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Will Buy Electric Equipment With Export-Import Credits

Funds for the purchase of U. S.-made electrical equipment are contained in two credits, of $650,000,000 and $3,000,000 to the French and Ethiopian governments respectively, the Export-Import Bank announced recently.

About $290,000,000 of the French credit will be used to pay for equipment already ordered, of which $10,000,000 is electrical equipment. Of the $170,000,000 allotted to new equipment orders, $70,000,000 will be used for the purchase of machine tools, construction power and other industrial machinery.

Another $90,000,000 will be used to pay for U. S. services, including engineering and similar work.

The Ethiopian credit of $3,000,000 will be used to purchase vehicles, tires and machinery, including copper wiring, transformers and 1- to 40-hp. electric motors.

Both credits are available up to June 30, 1948.

•

New Generator Relieves City Plant Power Shortage

With consumption at an all-time record high, arrival of a new 1,000-kw. Westinghouse generator was expected to alleviate the threatened power shortage in the town of Conway, Ark., which has a municipal plant and system. Generation of the Conway plant was 514,000 kw.-hr. in June, an increase of 109,200 kw.-hr. over the same month in 1945.

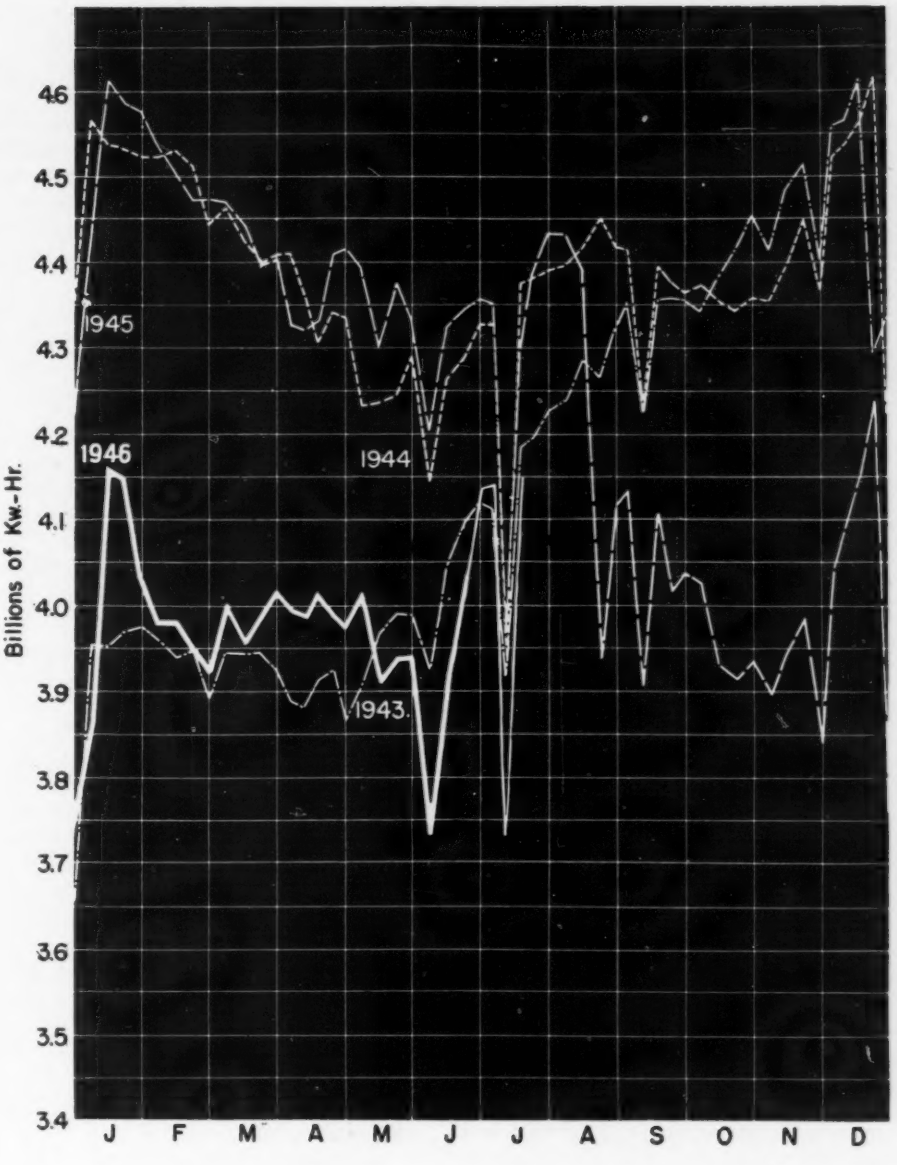
Meanwhile, another municipally owned system in Arkansas, at Forrest City, is facing power rationing because of load growth unless a 1,000-kw. unit it has ordered can be delivered shortly, or some other unit obtained.

•

REA Approves New Loans to Rural Cooperatives

Rural Electrification Administration has recently approved loans to 31 cooperatives in 20 states. These funds will be used to finance rural electric power facilities, including 2,479 miles of distribution lines to provide service to 8,960 farms and other rural establishments, system improvements and generating facilities, refrigeration plant facilities, farmstead wiring and plumbing and purchase and installation of electrical appliances.

Construction will proceed as rapidly as materials and manpower can be obtained.



Electric Output Curve Swings Upward

The electric output curve swung sharply upward during the week ended July 13, 1946, according to figures released by the Edison Electric Institute, reaching the highest point since mid-January. The amount of electrical energy distributed by the light and power industry totaled 4,156,386,000 kw.-hr. during the week ended July 13, comparing with 3,741,006,000 kw.-hr. during the preceding week. During the week ended July 14, 1945, the amount of electrical energy distributed amounted to 4,295,254,000 kw.-hr., this year's figure representing a decrease of only 3.2 percent.

Three of the seven major geographical regions of the country showed increases as compared with the corresponding week of last year, the New England states entering the plus column with a gain of 1.0 percent. For the preceding week it showed a loss of 4.7 percent. The over-all decrease for the country—3.2 percent—compares with a drop of 6.0 percent for the week ended July 6.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
July 13	4,156	July 14	4,295	July 15	4,377
July 6	3,741	July 7	3,978	July 8	3,941
June 29	4,133	June 30	4,353	July 1	4,327
June 22	4,129	June 23	4,358	June 24	4,325
June 15	4,030	June 16	4,348	June 17	4,287
June 8	3,920	June 9	4,327	June 10	4,265
June 1	3,741	June 2	4,204	June 3	4,144
May 25	3,942	May 26	4,330	May 27	4,292
May 18	3,939	May 19	4,377	May 20	4,246
May 11	3,911	May 12	4,302	May 13	4,238
May 4	4,012	May 5	4,397	May 6	4,234
Apr. 27	3,977	Apr. 28	4,416	Apr. 29	4,336

Percent Change from Previous Year

	July 13	July 6	June 29
New England	+ 1.0	— 4.7	— 0.4
Mid-Atlantic	— 1.8	— 4.0	— 2.1
Central Industrial	— 5.5	— 8.7	— 6.2
West Central	+ 2.5	+ 0.6	+ 1.5
Southern States	— 3.6	— 8.0	— 8.0
Rocky Mountain	+ 2.3	+ 5.8	+ 1.8
Pacific Coast	— 5.0	— 5.6	— 7.6
Total United States	— 3.2	— 6.0	— 5.1

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

VIRGINIA ELECTRIC & POWER CO.'s proposal to sell $6,500,000 of unsecured promissory notes to fourteen banks and an insurance company has been approved. The notes, maturing serially from next February 1 to August 1, 1956, will bear interest at the rate of 1¾ percent. The company plans to use the proceeds to retire outstanding notes and other securities and to make capital additions. (Release No. 6763).

ARKANSAS MISSOURI POWER CORP. has been authorized to sell $500,000 of first mortgage series B, 2¾ percent bonds to the John Hancock Mutual Life Insurance Co. at approximately 101.5 percent. The bonds, dated June 1 and maturing on June 1, 1976, will yield 2.0 percent to the date of maturity, plus accrued interest. The utility company intends to use part of the proceeds for additions to and improvement of its electric and ice properties. (Release No. 6758).

AMERICAN POWER & LIGHT CO.'s proposal to purchase 490 common shares of Washington Water Power Co. at $18 a share from officers and directors of the latter utility has been cleared by the commission. American owns approximately 99.7 percent of the 2,541,800 shares of Washington Water Power outstanding. American Power told the commission it desires to acquire the minority holdings to facilitate future steps in meeting requirements of the Holding Company Act. (Release No. 6759).

•

Dubuque Votes Renewal of Interstate Franchise

Citizens of Dubuque (Iowa) by a majority of 32 to one have voted to renew the 25-year electric franchise held by the Interstate Power Co. The bus franchise, held by the company, was also renewed.

A total of 2,453 persons voted in the special election, of which 2,276 were in favor of renewing Interstate's electric franchise and 2,240 the bus franchise. Seventy-three voted against the electric issue and 62 the bus.

City Council had previously put its stamp of approval on both franchises by unanimously approving their adoption.

Interstate and its predecessor company have been serving Dubuque for 25 years under the old franchise.

•

Birmingham Electric Has $902,891 Construction Plan

Substantial progress is being made on an expanded over-all modernization program which has been initiated by the Birmingham Electric Co. The company will spend $902,891 this year for additions and improvements to its distribution system. The utility buys its power from the Alabama Power Co.

Because of the shortage of domestic servants, the company expects a greatly increased demand for electric appliances and is recruiting and training sales personnel so as to be ready to develop this load as soon as appliances become available.

In order to take care of expanded demand for power, the utility is expanding its underground network in the downtown area.

•

Radiotelephone Link Sought for Three More Highways

Three more inter-city highways totalling more than 800 miles in length have been added to the two previously announced routes on which the Bell System plans to provide mobile radiotelephone service to vehicles.

American Telephone & Telegraph Co. has announced that applications have been made to the Federal Communications Commission for authority to construct transmitter-receivers along the highways between Washington and New York; Buffalo and New York, via Albany; and Los Angeles and San Diego. Permits to build transmitters and receivers for highway mobile radiotelephone service between New York and Boston and between Chicago and St. Louis already have been granted and construction of those stations is under way.

In addition, authority has been granted for Bell System highway radiotelephone stations in Cincinnati and Green Bay, Wis. Applications for installations in a number of other cities are pending or in preparation.

In this undertaking, requiring extensive research, planning and development of equipment, the Bell Telephone Laboratories is taking an active part.

UTILITY REPORTS

	Net Income 1946	1945
*Birmingham Electric	$1,111,474	$1,649,302
†El Paso Electric	820,233	754,297
*Electric Power & Light and subs	14,884,885	11,293,704
*Engineers Public Service and subs	7,088,633	7,759,094
†Gulf States Utilities	3,639,530	4,046,718
*New England Gas & Electric and subs	1,137,287	1,145,793
*Northwestern Electric	768,941	524,770
*Pennsylvania Power & Light	3,340,157	1,916,866
*Puget Sound Power & Light and subs	4,590,866	4,785,753
*Southwestern Public Service	1,678,207	1,550,532
†Virginia Electric & Power	6,059,099	6,550,926

* Twelve months ended May 31.
† Twelve months ended April 30.

Edison Foundation Elects Officers; Kettering Heads

Officers of the Thomas Alva Edison Foundation, incorporated recently "for the advancement of education and scientific research," were elected this week at a meeting of the trustees in the Llewellyn Park home of Mrs. Thomas Alva Edison, widow of the inventor.

Charles F. Kettering, vice-president in charge of research for General Motors Corp., was chosen president. The following were named vice presidents: Thomas J. Watson, president of the International Business Machines Corp.; Dr. Karl T. Compton, president of Massachusetts Institute of Technology; Dr. Robert C. Clothier, president of Rutgers University; Gano Dunn, president of the J. G. White Engineering Corp., and Frank F. Tait, chairman, Dayton Power & Light Co.

W. Winans Freeman, president of the Edison Pioneers, was elected treasurer and John Edison Sloane, grandson of the inventor, was named secretary. Mrs. Edison was elected honorary chairman, Mrs. John Eyre Sloan, the inventor's daughter, honorary vice-chairman, and former Gov. Charles Edison, a son of the inventor, honorary president.

•

Sacramento's 5% Bonds Sold at 50% Premium

A bond issue of $10,500,000 authorized by voters in the Sacramento (Calif.) Municipal Utility District in 1934 was awarded last week to the Bank of America, National Trust and Savings Association, at a premium of $5,225,627, or nearly 50 percent.

After years of litigation since authorization of the issue the district found it needed an extra $5,000,000 to meet its obligations. It therefore offered the bonds with a 5 percent coupon and the Bank of America took the issue for $15,725,627, announcing it was offering it to investors at prices to yield from a low interest rate of .85 percent on bonds maturing in 1950 up to 2.15 percent for those maturing in 1979.

•

Pays Off $106,000 Debt

Officials of the Murray (Ky.) municipally owned electric power plant have announced that the plant had paid off $106,000 of its $200,000 bonded indebtedness during its four years of operation, while reducing consumer rates by approximately 44 percent. The city-owned plant was acquired four years ago and contracted for use of power from the TVA.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Catwalk for Installing Vibration Dampers on Long Spans

M. A. KIRSCH,
Assistant Engineer, Line Construction, Pacific Gas & Electric Co., San Francisco

Problem—Some facility was required so that men could install a vibrating damping system 36 ft. out on the conductors of a series of long 220-kv. crossing spans of Pacific Gas & Electric Co. over the Sacramento and San Joaquin Rivers. Towers range in height up to 480 ft. and spans to nearly a mile in length.

Solution—The problem was solved with the hinged catwalk shown. It consisted of a wood pole 36 ft. long and a 25-ft. stiff-leg set at a 45-deg. angle. Both were hinged at the tower ends so that the catwalk could be raised from the ground and lowered while in a vertical position. Also, so that it could be hinged to a vertical position at night during course of the work to, (a) permit energizing of the line and, (b) to avoid unnecessary strain and vibration from high winds while not in use. A walkway and guard railing on the long pole completed the catwalk. The cantilever bridge on the tower end acted as a strut for the steel line used in raising and lowering the catwalk to and from the working position.

Procedure in placing the catwalk in position was to hoist it to proper height and chain the hinged plates to tower members. Then a steel winch line attached near the outer end of the long pole and acting over the bridge mentioned was used to raise the catwalk to proper position under the conductor, and at that point to support it during progress of the work.

TWISTING ½-in. aluminum armor rods on 220-kv. transmission conductor from catwalk on 480-ft. tower. Catwalk is hinged at tower

Alternate Methods—The only alternate to the catwalk was riding the conductor in a boatswain's chair. This method was used on a former job when resilient-type dampers only were installed, and these out on the conductors for only a matter of 16 ft. or so. This was entirely impracticable when ten ½-in. aluminum armor rods were spiraled onto the conductors with a special wrench; parallel aluminum conductor reinforcing damper wires, and resilient dampers used on the final job had to be installed.

Results—The catwalk idea resulted in a quick, easy method of providing a safe, substantial and adequate working platform.

• • •

Electronic Relays—I*

Vacuum Tube Type

W. D. MACGEORGE,
Director of Research,
Automatic Temperature Control Co., Inc.
Philadelphia, Pa.

WAYS AND MEANS have been devised for making small electrical currents control larger ones. A large number of ingenious relays have been designed but, until some attention was paid to the use of electronic tubes in this field, the results left much to be desired.

At present there are a number of "electronic relays" on the market and, since the potential uses of these devices are multitude and their construction presents no appreciable problem, new designs are appearing frequently.

Basically, these "electronic relays" may be divided into three main groups —vacuum tube type; cold cathode type; thyratron type—and each will be discussed in succession.

Vacuum Tube Type—Fig. 1 shows

* Beginning a series of four articles. Illustrations are numbered consecutively throughout the series.

a fundamental circuit for this type of unit. Tube V_1 usually a medium Mu triode such as the 6J5, is biased to, or near, cut-off by the bias supply B_2. In this condition little or no current flows through the relay-plate-cathode circuit. However, when the control contacts S_1 are closed the grid of the tube is connected directly to the cathode. This reduces the bias on the tube to zero and a current of between 6 and 10 ma. flows through the relay and pulls it in. Obviously the current-multiplying effect of such a circuit is quite large. If we assume a bias voltage of minus 10 volts and a grid resistor of two megohms, the maximum current that can flow through the control contacts S_1 will be 10 volts/(2x10^6 ohms) or 5 μa. The contacts on the relay can be easily designed to handle a single, or dual, 3-amp. inductive circuit. This gives a current amplification of 3 amp. /0.000005 amp. or 600,000. For non-inductive circuits the relay contacts can be rated at a higher current capacity and the current amplification factor may run as high as two or three million.

If the contacts S_1 present a high resistance when they are in the closed position, the bias will be only partially removed from the grid of the tube and the plate current will not rise to its full value. This may cause the relay action to be erratic and prevent the "snap" action which is usually desirable in this type of equipment. This condition may be corrected by using a relay which has mechanical snap-acting contacts such as a telephone type relay coil and armature operating a precision switch.

On the other hand, this type of "electronic relay" has one feature which will not be found in the two types to be discussed later. This feature is "time delay." Since the bias circuit of the tube must be direct current to obtain proper operation, it is quite possible to incorporate resistive and capacitive components in this circuit to delay the action of the grid and therefore, of the relay. A suitable condenser connected as C_1 (see dotted lines in Fig. 1), will serve this purpose. If such a condenser is incorporated in the circuit the relay will not respond to very rapid changes in contacts S_1 and for this reason, contact chattering can be minimized and suitable time delays for certain applications can be introduced to obtain a desired effect.

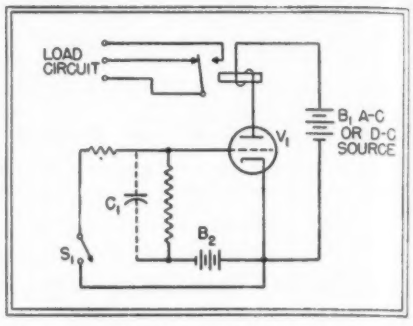


FIG. 1—Fundamental circuit for a vacuum tube type contactor

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Dielectric Heat Used In Molding Insulation

W. C. SEALEY

Transformer Dept., Allis-Chalmers Mfg. Co., Milwaukee, Wisc.

IN THE PROCESS of developing applications for its new line of dielectric heating equipment, the Allis-Chalmers Mfg. Co. has worked out a successful method of using dielectric heating in the formation of transformer insulating collars. Previously these collars were made by moulding insulating paper and heating it in a steam press, or by using laminated insulating material, cemented together with shellac or synthetic binder, and cured by baking the mold in an oven.

MOULDING INSULATING COLLARS — Sheets of fullerboard soaked in water are moulded between dies of this hydraulic press and dried under pressure by dielectric heat to form transformer insulating collars in 5 to 10 min.

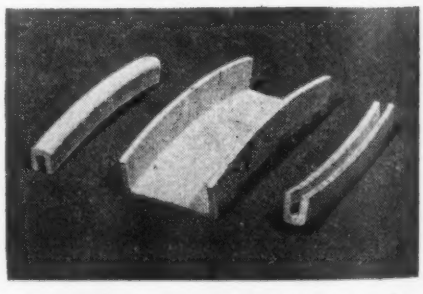
Since an insulating collar made of untreated fullerboard, when thoroughly dried and then oil-soaked, has a dielectric strength which is often twice that of a built-up collar, the use of this type of collar enables transformers to be built more compactly without increase in heating or loss of efficiency.

While such collars may be formed in a press using steam heated molds, the use of dielectric heating has the following advantages:

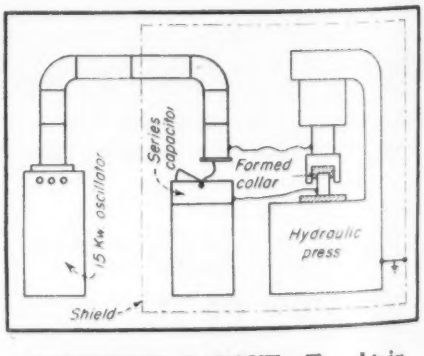
1. Molds are much simpler and less costly since they can be constructed of steel plate without steam cavities.

2. Molds are much lighter to handle; setup time is reduced to a few minutes.

3. Heating time is approximately



FINISHED INSULATION—Sample insulation strips were formed and dried by dielectric heating process



EQUIPMENT LAYOUT—To obtain optimum rate of heating, tuning of the high frequency circuit is changed by remote control from outside the shielded cage around the unit, as drying proceeds. Shielding prevents power waste and radio interference

half the heating time for steam-heated molds because the heat penetrates faster into the interior of the insulation. Usual heating time is from five to ten minutes as contrasted with ten to twenty minutes with steam-heated molds. Complete drying is thus assured.

The process of making a collar starts with soaking fullerboard sheets of the desired thickness in water. The female part of the mold or die is located on the moving part of the hydraulic press and is forced down on the wet material, pressing it into the desired shape. Dielectric heat is then applied at a frequency of 10,000 kc. until the fullerboard is dry.

To obtain the optimum rate of heating, it was found desirable to change the tuning of the circuit as dryout proceeds. This is accomplished by adjusting a remotely controlled series capacitor from the outside of the shielded cage surrounding the unit. The lower part of the die is insulated from the press by a thick slab of insulating material.

Care must be taken to shield the high frequency equipment in order to eliminate power waste and radio interference, as well as stray voltages and heating in adjacent machinery.

• • •

Meter Insulation Tester Has Safety Feature

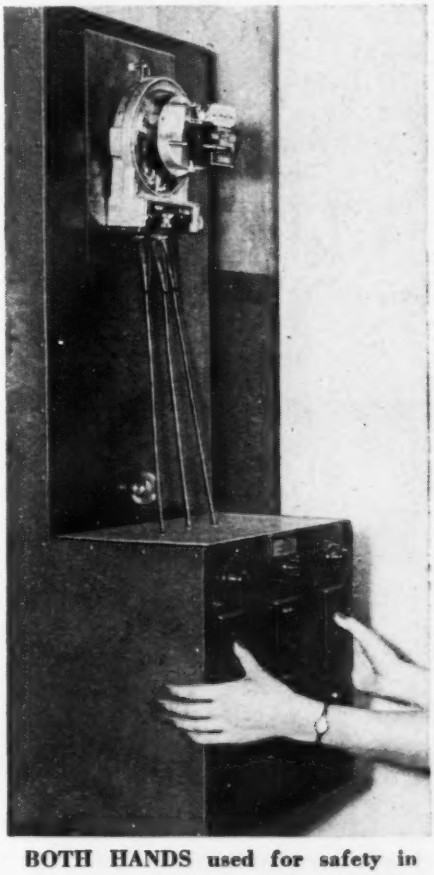
F. H. ROGERS,
Supt., Meter & Installation Dept., Consolidated Gas, Electric Light & Power Co. of Baltimore

HANDS THAT OPERATE the watthour meter insulation tester in our company do so in perfect safety because each must hold a low-voltage momentary contact toggle switch in order to energize the high-voltage test leads. As the high voltage side of the tester is immediately de-energized when either of these switches is released, it is impossible for the operator to touch any part of the high-voltage equipment, or the meter under test, while it is alive.

Tester case is constructed of angle iron and ½-in. pressed wood, and is mounted on a wall. A potential transformer, rewound and tapped on the low side for ratios of 10 and 20 to 1. is used to step up the voltage. A double-throw toggle switch is connected on the low voltage side to select the desired test voltage, either 1,000 or 2,000 volts. A green indicating light signifies that the circuit to the tester is alive, and a red indicating light glows when the high-voltage circuit is alive. The glow of a neon lamp, connected in the high-voltage side and shunted by a suitable resistance, indicates an insulation failure. The current is limited by 120-volt incandescent lamps in series with the low-voltage circuit, and the test voltage is limited by a spark gap across the high-voltage side.

The watthour meter to be tested is suspended from a grounded screw, the case resting against a grounded metal plate, an adapter being provided to hang socket type meters. Three test leads are provided, one each for the two current coils of a 3-wire meter or element, and one for the potential coil. The insulation is tested between coils and case, and between the two current coils. An S.P.D.T. rotary snap switch, the handle of which is insulated by an 8-in. piece of wood doweling, switches the potential on one current coil from ground potential to test potential. When testing two-wire single-phase meters, the use of only one test lead is required.

The test leads are kept taut and are pulled inside of the box when not in use by three weights, each with a pulley attached, through which the leads are threaded. Thus all leads are kept at a safe distance from the operator when they are energized. This equipment has been in use for several years and has given very satisfactory safe service.



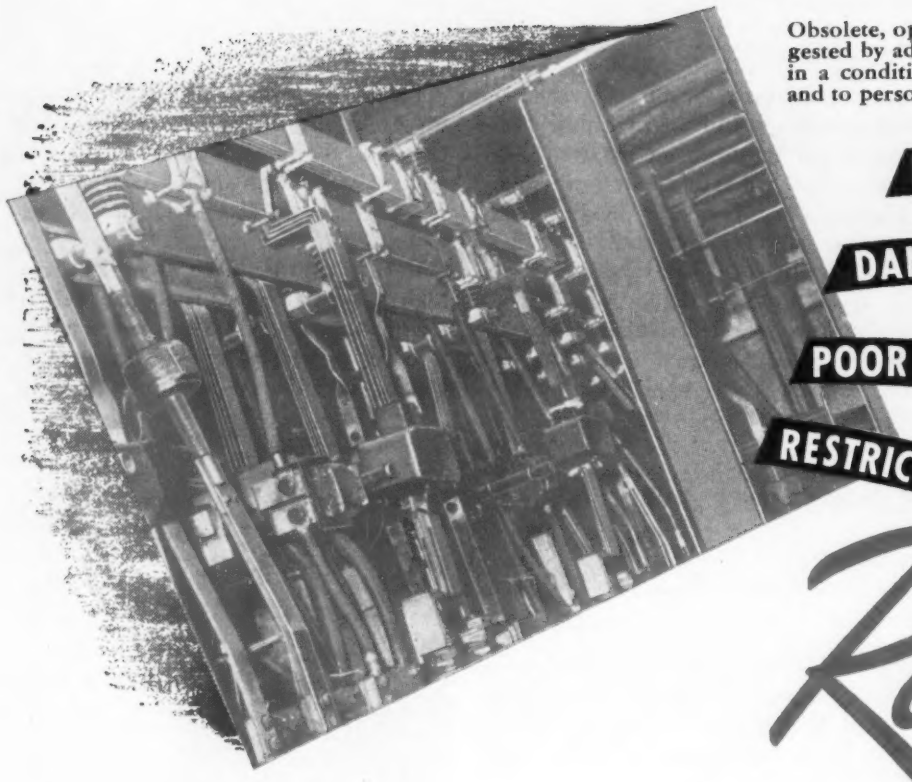
BOTH HANDS used for safety in closing low voltage switches to energize high voltage circuit

• • •

Repairing Ornamental Standards after Accidents

AN EFFECTIVE ROUTINE for repairing ornamental lamp standards after these have been knocked down by motor vehicle collision has been developed by the Quincy (Mass.) Electric Light & Power Co., a New England Power System utility. It applies principally to Union Metal standards in which the anchor bolts extend to a plate at the top of the cast base. As a rule, when one of these standards is knocked down, one or more of the anchor bolts is broken flush with the top of the foundation. Formerly it was common practice to remove the old foundation and replace with a new one. The present procedure is:

1. Make a coupling from steel rod, ¼ in. to ¾ in. larger diameter than the anchor rod involved, by cutting off a 2-in. length, drilling and tapping it with a bolt thread of anchor rod size.
2. Chip away foundation around broken anchor bolt to a diameter and depth to permit threading for 1 in.
3. File the broken end of the anchor rod smooth and thread for 1 in.
4. Thread the old, or if necessary, make a new upper section and install by means of the coupling.
5. Restore surface of foundation by grouting around bolt and coupling.
6. Replace standard.



Obsolete, open-type switchboard construction, congested by additions made from time to time, resulted in a condition dangerous to operating continuity and to personnel.

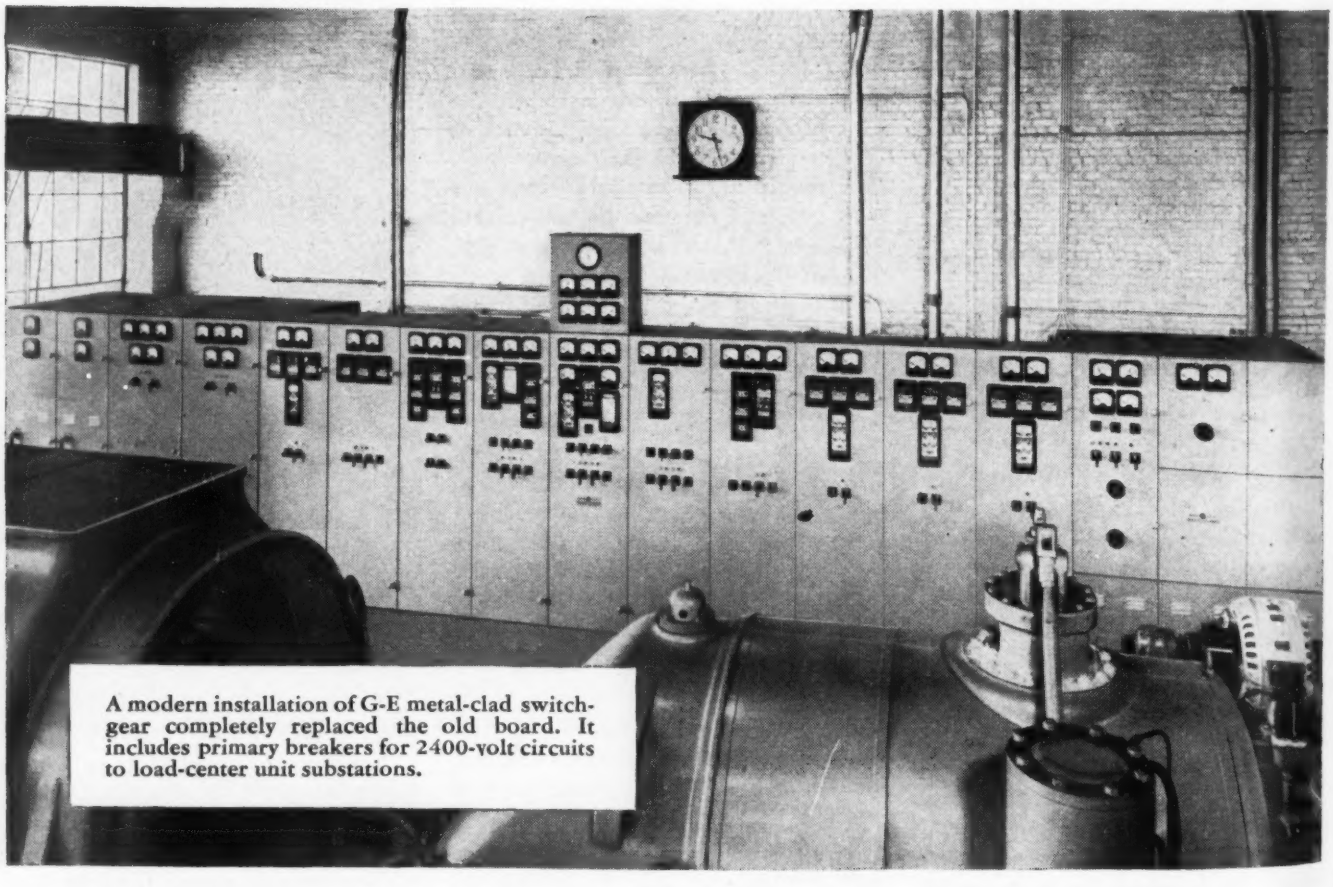
FREQUENT OUTAGES

DANGER TO PERSONNEL

POOR VOLTAGE CONDITIONS

RESTRICTIONS ON GROWTH

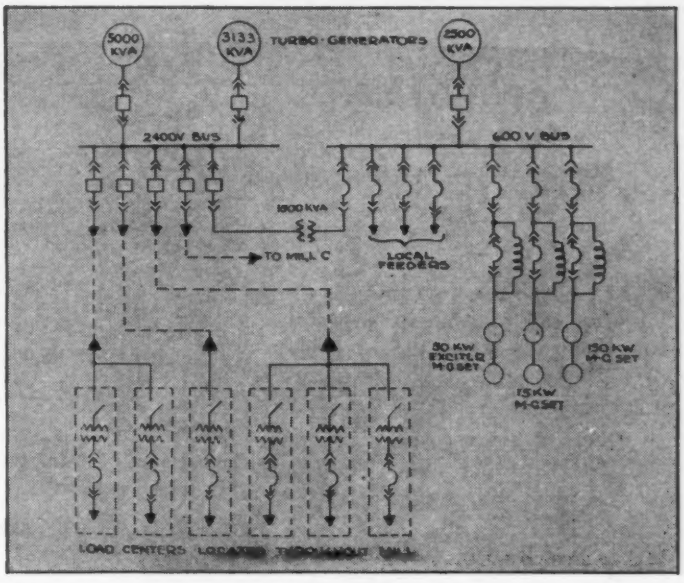
Removed



A modern installation of G-E metal-clad switchgear completely replaced the old board. It includes primary breakers for 2400-volt circuits to load-center unit substations.

GENERAL ELECTRIC

321-45-5900



Switchgear and Load-center Unit Substations are Shown in this One-line Diagram.

Originally, the 5000-kva generator was wound for 600 volts, and all but one circuit (to mill C) was powered from the 600-volt bus. The change to 2400-volt distribution brings short-circuit amperes to a value consistent with moderate-sized circuit breakers.

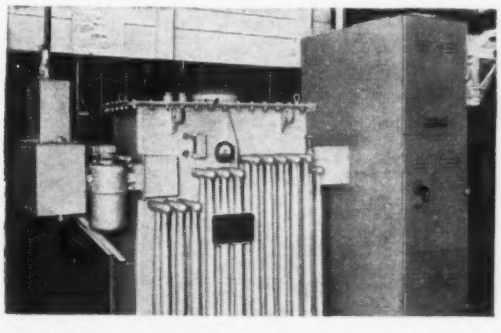
...BY G-E LOAD-CENTER UNIT SUBSTATIONS

• An old, inadequate plant power system was an open invitation to trouble at this mill. Electrical outages were delaying production. Circuits and switchgear which had been added piecemeal added to the danger of inadequate interrupting capacity. In spite of large secondary feeders, the distribution of 10,000 kva at 600 volts had created unsatisfactory voltage conditions.

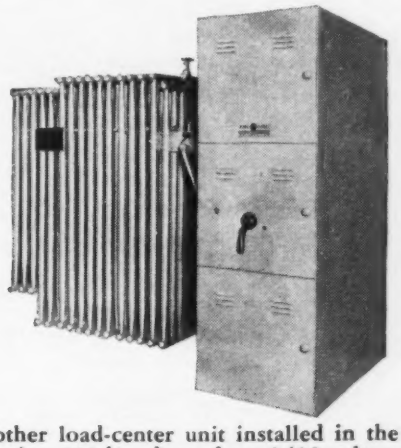
Analysis showed that further patchwork would be a costly practice. A new power distribution system, based on the use of G-E unit substations, was planned with the help of G-E engineers.

Now primary distribution is made at 2400 volts over cable that keeps voltage drop down, though it's modest in size. The powerhouse switchgear is all G-E metal-clad, equipped with magne-blast oil-less air circuit breakers. At load-center locations throughout the plant, six unit substations are installed, to step down from 2400 volts to 600. Individual circuits are fully protected by convenient metal-enclosed drawout air circuit breakers that are an integral part of the unit substation.

This new protection against outages and obsolescence is already justifying itself in power continuity and lowered costs. Why not determine, without obligation, if power-system replacement could do as much for you? Just call your local G-E representative. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Typical load-center unit substation, as installed at locations which permit short low-voltage feeders to points of power use.

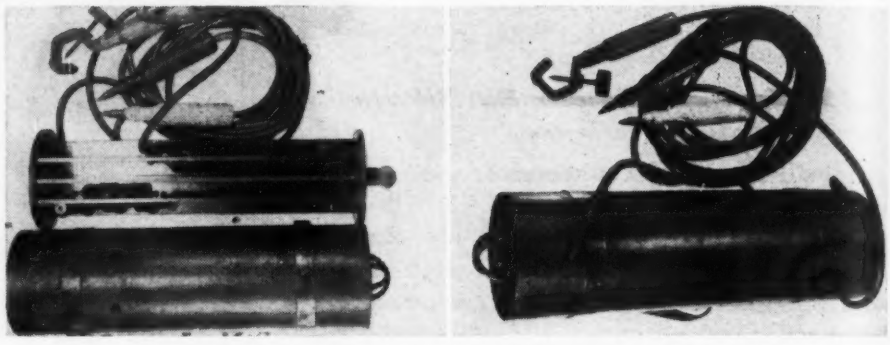


Another load-center unit installed in the mill, stepping 500-kva down from 2400 volts to 600. Draw-out air circuit breakers are co-ordinated with substation size to give full short-circuit protection without excess breaker size. Substation transformers use Pyranol non-inflammable insulating liquid.

LOAD-CENTER POWER DISTRIBUTION UNITS

Sequence Indicator For Primary Circuits

M. F. WIDER
Overhead Lines Dept.
The Detroit Edison Co.
Detroit, Mich.

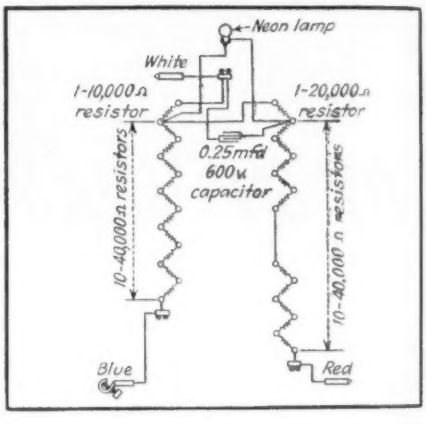


PHASE ROTATION INDICATOR—Used for determining phase rotation on 4,800-v., primary circuits this tester, consisting of neon lamp, resistors and condenser in 6-in. bakelite tube, avoids need for tracing out circuits; shown (right) assembled, (left) parts exposed and (below) circuit arrangement

IT IS OFTEN desirable to know the direction of phase rotation of primary (4,800-v.) circuits without tracing the circuit back to some point at which the phases are marked. This information is useful in making cutovers and in determining proper phase connections for an open-delta transformer installation. The indicator, shown, is one that is used by The Detroit Edison Co. for this purpose. Its circuit consists of twenty 40,000-ohm resistors, one 20,000-ohm and one 10,000-ohm resistor, all of 25-watt capacity, arranged as shown with a 600-v., 0.25-mfd. paper condenser and a 1-watt, 120-v. neon-glow lamp. These components are housed in a bakelite tube 6 in. in diameter and 20 in. long. The lamp is mounted in one end of the tube and the resistor and condenser within the tube. Leads are brought out of the sides and opposite ends of the tube.

With the three leads connected to a 4,800-v. three-phase primary circuit the lamp will be lighted for one direction of phase rotation and will be dark for the opposite direction of phase rotation.

For easy identification of the three phases, wooden handles of the test prongs are painted different colors. A strap is provided for hanging the tester from a crossarm or other support that may be convenient.



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Cost of a New Factory Substation

IN 1944 AN EASTERN power company built a 1,000-kva. substation for an industrial customer at an over-all cost of $6.60 per kva. Service was supplied from a 13.2-kv. feeder, and a transformer bank of three 333-kva. units delivers 575-volt energy to the plant distribution system. Labor costs are included in the accounting practice along with material and equipment, not being separately available in the company's report of the work; so that the tabulated costs represent the total expense of the job.

Itemized Cost of a 1,000-Kva. Industrial Substation, 1944

Items	No.	Unit Cost	Total Cost
333-kva. Transformers, 13.2kv./575 volts	3	$1,202.573	$3,607.72
Airbreak-Switch, 13.2-kv. rating	1	404.13	404.13
1,250 Mcm, 600-volt, rubber cov. wire	50 ft.	5.911	297.50
500 Mcm, 600-volt, rubber cov. wire	76 ft.	3.588	272.70
Lightning arresters, 13.2-kv.	3	19.163	57.49
Insulators, 13.2-kv.	12	18.629	223.54
Ground System, incl. 3 8-ft. ground rods	1	87.37	87.37
Concrete Foundation, 4 ft. x 15 ft.	1	572.83	572.83
35-Ft. Hard Pine Poles	4	60.38	241.53
10-Ft. Crossarms	6	10.871	65.23
Anchor Guys	2	18.515	37.03
Cone Anchors	2	3.065	6.13
Transformer Fence, Height 6 ft.	80 ft.	2.78	222.43
Insulators, 575-volt	12	8.799	105.59
Fuses, 13.2-kv.	3	102.656	307.97
Meter Equipment	.....	.....	24.99
Crossarm Stock, 4-in. x 5-in.	40	1.65	66.15
		TOTAL	$6,600.41

• • •

Single-Phase Switching Saves Outages

C. M. LYTLE
Supervising Engineer, Overhead System, Kansas City Power & Light Co., Kansas City, Mo.

PRIMARY PHASE outages going to lockout an average of once in 15.3 years, with single tripout and reclosure an average of once in 2.3 years is the summary of a record extending over 20 years on an average of 74 feeders of the Kansas City Power & Light Co.

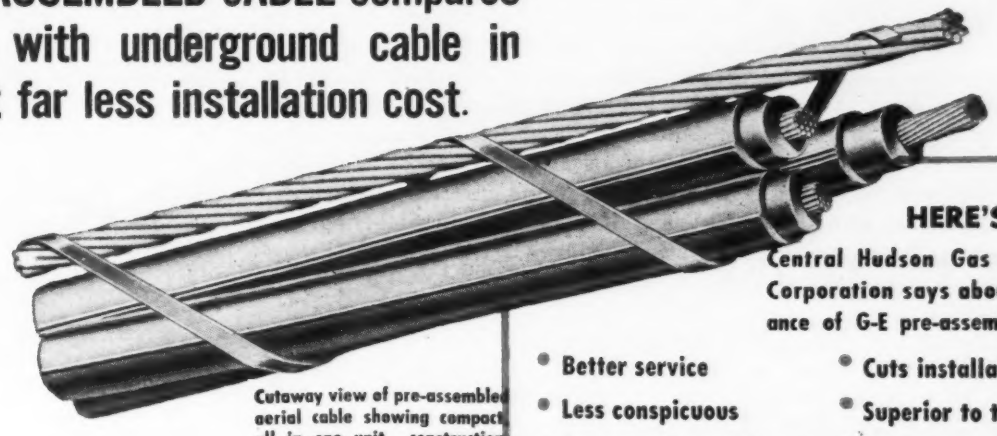
This 4,000-volt multigrounded neutral system is operated with single-phase switching and relaying at the substation and without branch line fusing. Main primary feeders are of No. 1/0 copper wire using single-phase 200-amp. rated regulators.

If three-phase tripping had been used on all circuits included in this report the record would have changed to

OVERHEAD CABLE DISTRIBUTION

Improves continuity

G-E PRE-ASSEMBLED CABLE compares favorably with underground cable in service at far less installation cost.



Cutaway view of pre-assembled aerial cable showing compact all-in-one-unit construction

HERE'S WHAT Central Hudson Gas & Electric Corporation says about performance of G-E pre-assembled cables:

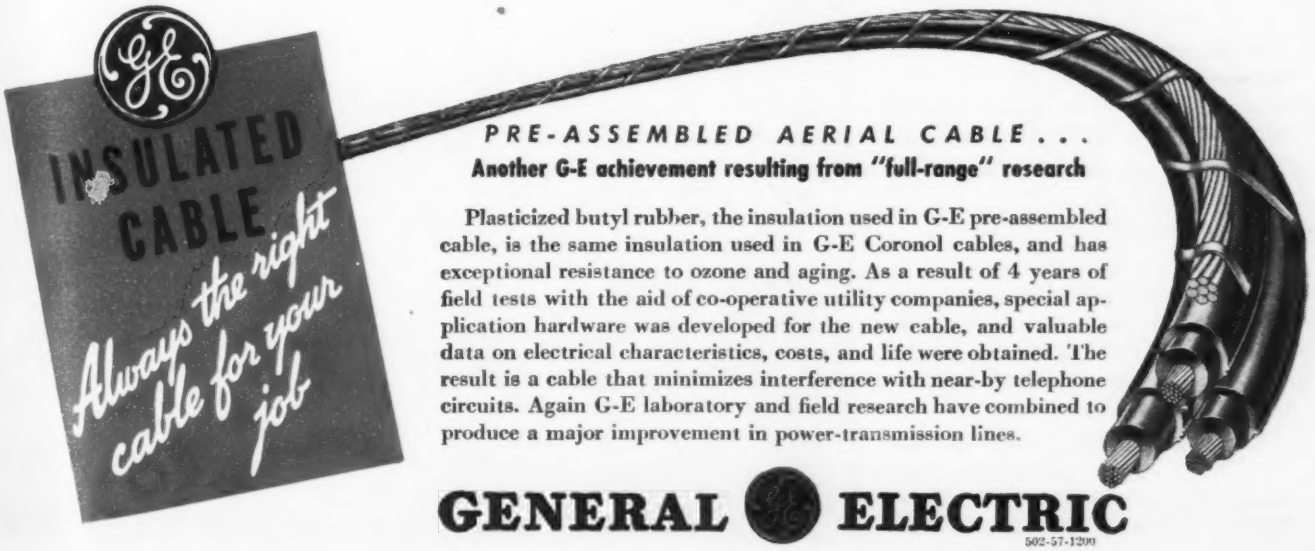
- Better service
- Less conspicuous
- Compares favorably with underground cable
- Cuts installation costs
- Superior to tree-wire
- No interruptions during hurricane

Picture a power-distribution system practically free from the hazards of ice, storms, and fallen branches—yet installed at a cost not much greater than open-wire or tree-wire construction. It's here today, in G-E pre-assembled cable. Already an impressive service record has been built up by the millions of conductor feet now in operation and more and more electric utilities are installing it every day.

G-E pre-assembled cable was developed to provide for easier installation, less conspicuous appearance, and better service in aerial cable installations. Messenger, rings, and cable are all factory-assembled and delivered ready for pulling in on poles. Because G-E pre-assembled cable is strung as a unit, it reduces the time that linemen are needed on poles by as much as 75 per cent. Actual cost of installation may be cut up to 40 per cent.

Many other features contribute to the outstanding performance of G-E pre-assembled cable. It may be tapped without reinforcing the messenger. Temporary repairs are easily made by linemen. Installation is rapid, a good average being 3000 feet per day. Periodic tree trimming is entirely eliminated. In addition, as compared with use of bare secondary wire, the hazards of installing the cable under existing open-wire primary lines are greatly reduced.

G-E pre-assembled cable is available in one conductor and three conductor types. Get in touch with your nearest G-E office for performance data and the complete facts on this modern aerial cable. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



PRE-ASSEMBLED AERIAL CABLE . . .

Another G-E achievement resulting from "full-range" research

Plasticized butyl rubber, the insulation used in G-E pre-assembled cable, is the same insulation used in G-E Coronol cables, and has exceptional resistance to ozone and aging. As a result of 4 years of field tests with the aid of co-operative utility companies, special application hardware was developed for the new cable, and valuable data on electrical characteristics, costs, and life were obtained. The result is a cable that minimizes interference with near-by telephone circuits. Again G-E laboratory and field research have combined to produce a major improvement in power-transmission lines.

GENERAL ELECTRIC

502-57-1209

"a primary phase outage going to lockout an average of once in 7.37 years, with single tripout and reclosure an average of once in 1.14 years."

Of the total 291 phase lockouts, 142 involved only one phase of a feeder, 56 involved two phases of a feeder and 93 involved all three phases of the feeder, covering a total of 4,449 phase-years of operation.

Service was reestablished in 82.2 percent of the phase outages on the first reclosure, with a 15-second outage time. In 4.8 percent of the phase outages the second reclosure was effective, with a total outage time of 45 seconds. The third reclosure was used in only 0.6 percent of the phase outages, with a total outage time of 120 seconds.

In the light of this 20-year experience it is obvious that the value of the third reclosing cycle is negligible. Consideration is now being given to the elimination of this third reclosure and possibly the second reclosure. It is thought that normal relaying with 15-second delay to reclosure will change the over-all picture so little as to justify its adoption for new circuit installations.

Credit for this record cannot be given entirely to the single-phase switching. Much effort and money is expended in maintaining clearance of lines from trees. Trees are the biggest source of difficulty, either whipping wires together or limbs breaking and falling onto the wires. With the advent of less costly aerial cable much of this difficulty may be eliminated in areas where there is opposition in obtaining permission to trim trees for adequate clearance with the conductors.

Summary of Single-Phase Tripouts
20 Years - 4,449 phase-years of service

Involving	One Trip-out	Two Trip-outs	Three Trip-outs	Lock-outs
One Phase—				
A	234	13	2	53
B	297	25	3	48
C	241	13	1	41
Total Phase	772	51	6	142
Two Phases—				
AB	229	2	1	14
BC	166	4	1	10
AC	43	0	0	4
Total	438	6	2	28
Total Phases (× 2)	876	12	4	56
Three Phases—	94	17	1	31
Total Phases (× 3)	282	51	3	93
Total Tripouts	1304	74	9	201
Total Phases	1930	114	13	291

	Phases	Percent
Service Re-established:		
On first reclosure	1930	82.2
On second reclosure	114	4.8
On third reclosure	13	0.6
Lockouts	291	12.4
Total	2348	100.0

• • •

Reserve Exciters And Their Connections

H. W. EALES*
Electrical Engineer, Public Utility Engineering & Service Co., Chicago, Ill.

DURING the war years, due to limitations in procurement of reserve equipment, some stations were designed with both a single unit and two units initially; each with its own exciter but with no reserve exciter. Experience gained from this arrangement leads to the following conclusions:

1. In normal times it is without question good judgment to provide a spare exciter set if two or more main units are to be installed initially.

2. Since a sizable 3,600-rpm. shaft-driven exciter armature costs somewhat more than an equivalent induction motor-generator exciter set, it seems prudent to employ an induction motor-driven exciter set as the reserve.

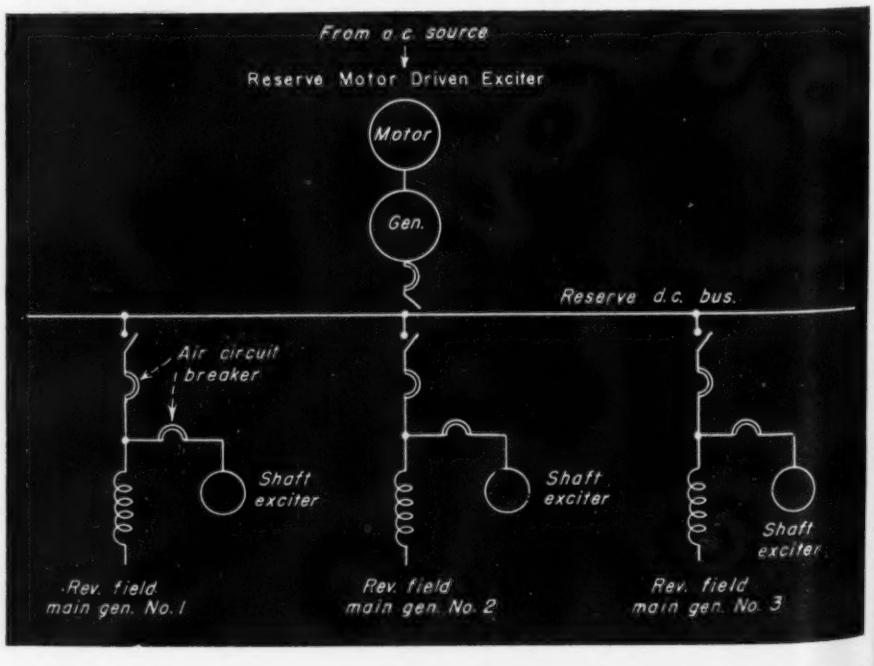
3. Capacity of this set should be capable of supplying excitation to the probable largest unit in the station.

4. It is also considered wise to install a motor-driven reserve exciter set with the initial single-unit in a power station if there is a likelihood that a second main unit is in prospect in from three to five years.

5. Importance of the load to be handled out of a single-unit station is also of considerable importance in influencing a decision to install a reserve exciter set with the first main turbine generator unit.

The accompanying diagram shows a simple scheme of connections which permits a reserve exciter to be substituted for the shaft-driven exciter or any unit in a station. It consists of an exciter bus supplied by reserve exciter with taps taken off to each main generator. This involves one extra circuit breaker for each main generator field in addition to the breaker from its own exciter. Just how the transfer should be made is dependent upon the seriousness and the nature of the distress to the shaft-driven exciter and upon operating methods of different companies.

CONNECTION SCHEME—Reserve exciter connected to revolving fields of several main alternators through bus and suitable breakers



* From a paper presented at the E.E.I. Electrical Equipment Committee Meeting, May 7, 1946, at Chicago, Ill.

load for you now . .

EDGAR BERGEN
knows better than to bulbsnatch.

GEORGE BURNS
when he catches . . .

GRACIE ALLEN
in the act of bulbsnatching.

HOLLYWOOD'S LEADING COMIC STARS

now appearing in

G-E's GREATEST BULBSNATCHING CAMPAIGN

HERE'S NEW SUPPORT for your lighting promotion! G-E's new fall lamp advertising is bringing Fred Allen, Groucho Marx, George Burns and Gracie Allen, Charlie McCarthy and Edgar Bergen right to your service area to put their tremendous popularity behind a hard-hitting campaign to fill empty lamp sockets.

IMAGINE the eye-catching appeal of hilarious situations with these beloved comedians caught red-handed at bulbsnatching, that all-too-familiar practice of robbing one lamp socket to fill another. Bulbsnatching—G-E's own exclusive, sales-proved lamp promotion—is a natural tie-in with your own load-building activities, because it gives people a real incentive to *stock up* on lamps and keep every socket filled.

THAT SETS THE STAGE for an effective, fast-moving campaign, with each ad carefully designed to supplement your own efforts to keep empty sockets filled with right-size lamps.

The Anti-Bulbsnatching Campaign

is just another example of G-E's many activities that work hand-in-hand with utilities to sell better lighting.

How to Identify Insulator Position On Electrical Supply Lines

Much of the ambiguity that has marked the identification of pin or insulator positions on both transmission and distribution lines has been avoided in the numbering systems used by the Wisconsin Power & Light Co. The accompanying adaption is from the company's new publication "Handbook for Construction of Electrical Supply Lines."

Distribution Lines (Below 26.4 Kv.)

PIN POSITIONS on low and medium-voltage supply lines are identified by figures as shown in the sketches under the heading "Supply Lines Below 26.4 Kv."

The left-hand pole pin when viewed facing in the direction of power flow (or increasing pole numbers), is designated as No. 1; the right-hand pole pin No. 2, and so on. Pins to the left of the pole have odd numbers; to the right, even numbers.

When side arms are used, the pin position number is the same as for a center-supported arm having the same number of pins.

When triangular construction is employed, the top pin or conductor support is always No. 11. This number is used to avoid any necessity for changing it in event ten-pin arms are used. It is also the position number used in this company to designate ridge pins on high-voltage lines for many years.

Transmission Lines (26.4 Kv. and Above)

In crossarm construction pin positions are numbered as on distribution lines. Since transmission arms do not exceed four-pin positions and since a circuit may occupy more than one arm, numbering continues consecutively to the next lower arm.

Construction that embodies a pole-top pin for the support of a conductor is always No. 11. Ground or static wires are not numbered.

When lines carry two circuits, one on each side of the structure, (and the source and terminus of both lines the same) the circuit on the left side of the structure (facing direction of structure number or "normal" power flow) is designated as line No. 1. The circuit on the right is No. 2.

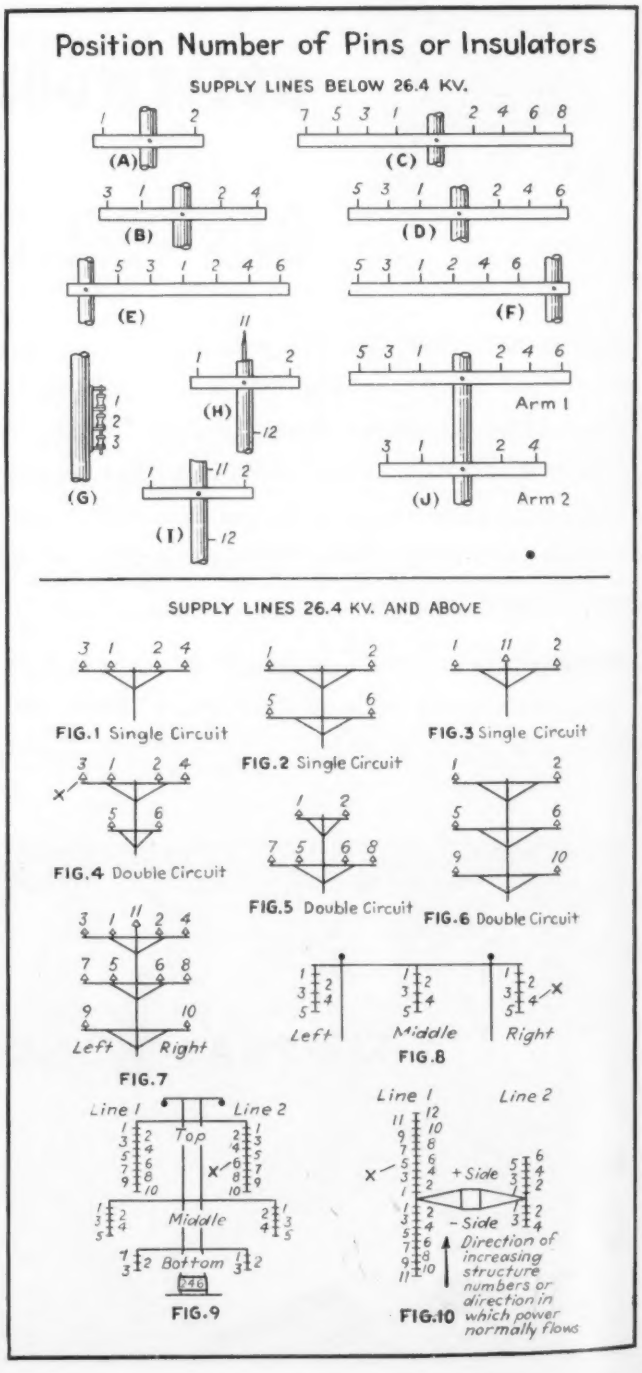
In strings of suspension insulators No. 1 insulator is always adjacent to the crossarm or support. Suspension insulators in a dead end position on the "load" side of the structure are said to be on the (+) plus side. Insulators on the source side of the structure are on the (−) minus side. Crossarms are referred to as Top (T), Middle (M), and Bottom (B).

In Fig. 4 the insulator marked "X" is identified as: Structure No. (−), position No. 3.

On H-type structures as in Fig. 8, location of conductors and insulator strings is referred to as Left, Middle, or Right —again when facing in the direction of structure numbering. The insulator marked "X" in Fig. 8 is: Structure No. (−), position 4, right conductor and name of line.

The insulator marked "X" in Fig. 9. is identified as: Structure 246, Line 2, position 6, top arm and add name of line, or 246-2-6-T- Prairie du Sac-Portage 66 kv.

In Fig. 10, insulator "X" is identified as: Structure No. (−), Line 1, position 5, top arm plus side, and name of line.



when cable runs must "run the gauntlet"

a DELTABESTON* cable will give extra assurance of uninterrupted power

Conditions that shorten the life and threaten the performance of regular types of cable are often unavoidable around the power plant. But that's just where the chances of a cable failure *can't* be allowed to rise.

How can you maintain the same safety factor under *extra severe* conditions that you expect from standard power cable under normal conditions? The answer may lie in a DELTABESTON Cable of special construction, like the one shown here. It's one of many developed to "run the gauntlet" of unusual conditions for central stations and power plants.

Probably, this particular cable is *not* the one you'll need to meet your combination of conditions. In most cases, one of the regular Deltabeston types will do so. But remember that specialists in heat-resisting cable are always "on call" to select or even develop a Deltabeston construction that will maintain an adequate safety-factor for years to come.

* *Trade-mark Reg. U.S. Pat. Off.*

For a copy of the Deltabeston Cable catalog, write Section Y-3-79, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. Deltabeston Wires and Cables are distributed by G-E Merchandise Distributors.

GENERAL ELECTRIC

How To Test For Ground At Service Connection

Routine tests of single-phase services for grounds have been used advantageously by an eastern utility supplying from 50,000 to 75,000 customers. These tests apply only where voltage to ground is under 150 volts.

EVERY EMPLOYEE required to make connections to customers' services or to other secondary grounds is provided with a Wigginton tester and a clear-bulb, 115-volt, 10-watt lamp for use in places where the Wigginton tester will not serve. A ground test is made before connecting to any service entrance, whether new or previously cut open for any reason.

Before testing, a check for live secondary wires at the service entrance is made by connecting the Wigginton unit to each pair of company wires in turn, to show about 230 volts between outer wires and about 115 volts between outer and neutral wires.

The customer's main switch is opened before making any further connections or tests. If no customer's service or external ground is already connected to the secondary system so that it is grounded, the tester makes certain that the entrance pipe is grounded and connects the neutral wire (or in a 2-wire system a pole-pin wire) of the secondary system to it before proceeding with the tests and connections. This connection to the entrance pipe is removed after the test is completed.

Test procedures follow:

Case A: Connecting 2-wire entrance to company 2-wire system.

Make tests as shown in positions 1 and 2, respectively, considering that the company No. 2 and customer's Z wires do not exist. If tests result as shown, connect customer's Y or white wire to company N or grounded wire and customer's X wire to company No. 1 wire.

Case B: Connecting 2-wire entrance to company 3-wire system.

Make tests as shown in positions 1, 2 and 3 respectively, considering that customer's Z wire does not exist. If tests result as shown, connect customer's Y or white wire to company N or grounded wire and customer's X wire to either company's No. 1 or No. 2 wire, according to which of the latter is the right or left wire of the system.

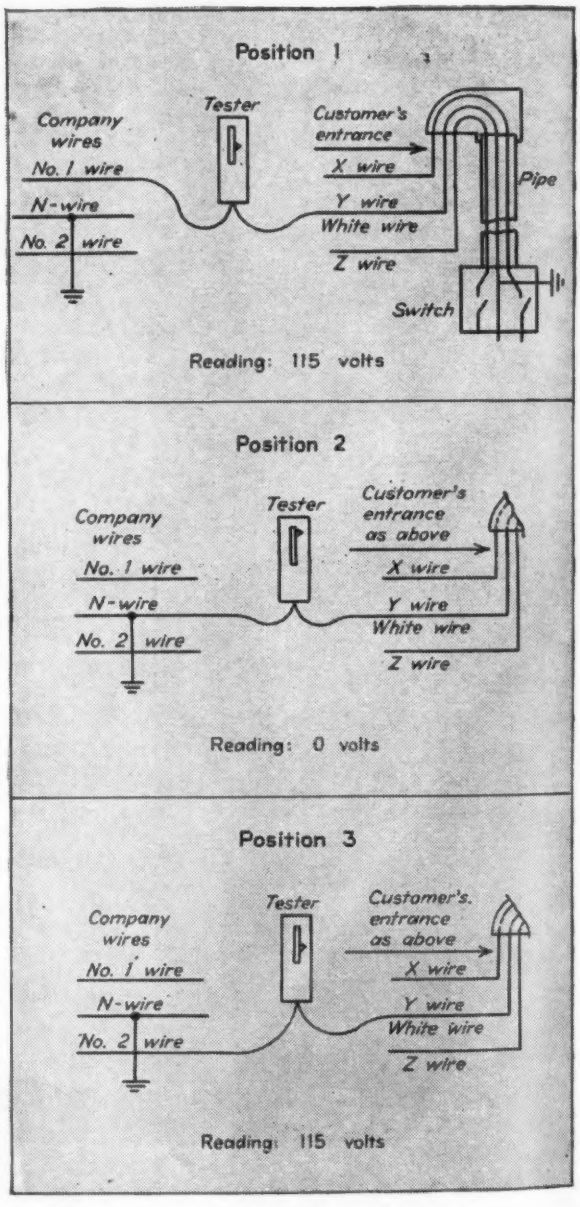
Case C: Connecting customer's 3-wire entrance to company 3-wire system.

Make tests as shown in positions 1, 2 and 3, respectively. If tests result as shown, connect customer's Y or white wire to company N or grounded wire, and customer's X and Z wires to company No. 1 and No. 2 wires respectively.

Case D: Connecting customer's 3-wire entrance to company 2-wire system.

Proceed as in Case B, but tie customer's X and Z wires together and treat as described for customer's X wire. If test does not result as shown, proceed as follows:

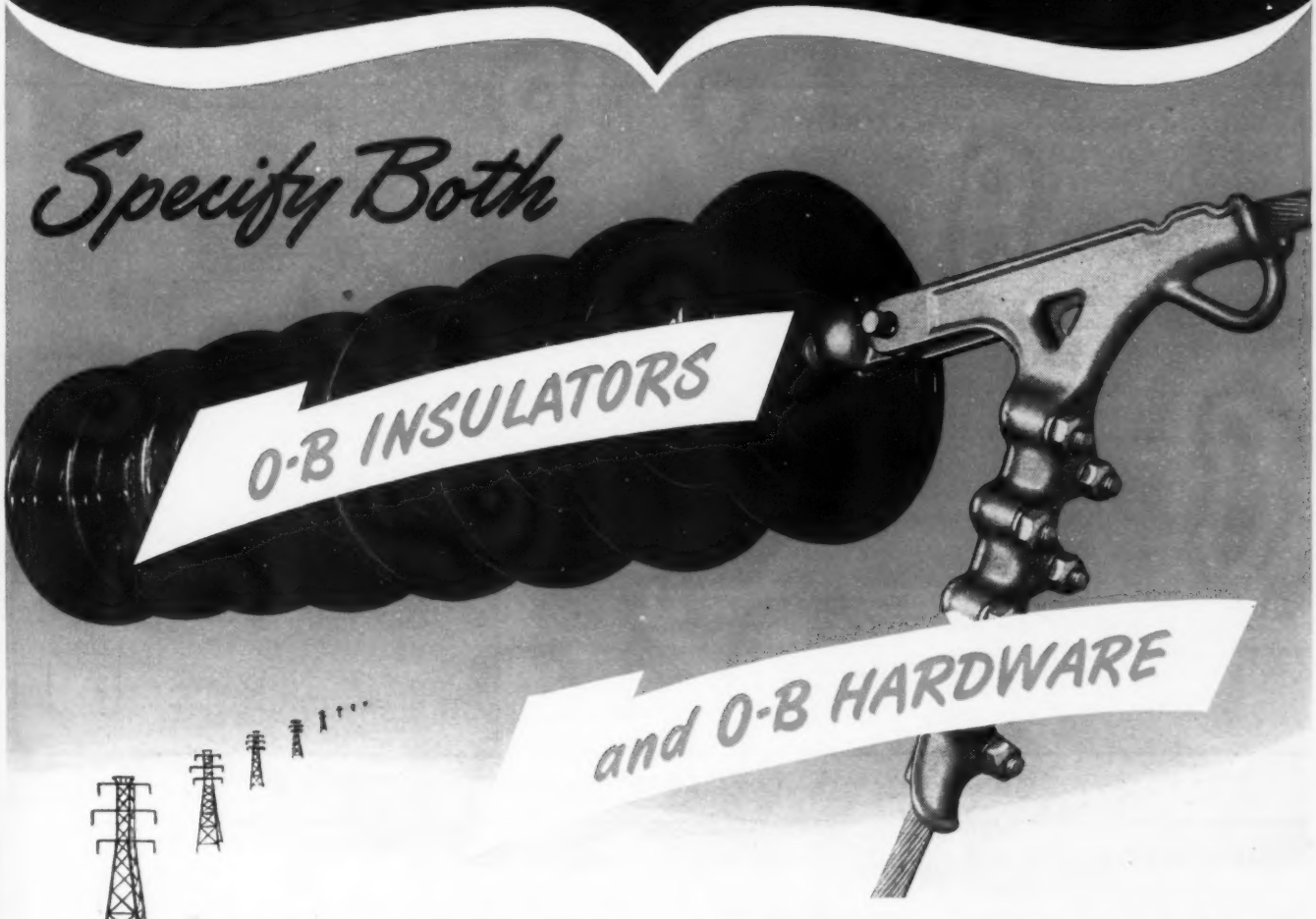
1. Disconnect customer's service ground connection, attaching to ground wire a tag marked "Caution—Not to be connected except by an electrician."
2. Identify company grounded wire at another entrance or some place where a reliable ground test can be made and trace this company grounded wire to the entrance in question, connecting it to the customer's white or Y wire.
3. Connect other wires as directed in the above cases. No spark whatever should result when connections are thus made. It is positively forbidden to test for the grounded wire at the customer's entrance by the so-called "flashing" method, i.e., touching a live wire to the suspected ground wire to see if a flash results.
4. Notify the company's meter engineer as soon as possible.

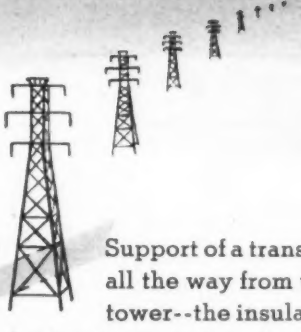


Method of testing for grounded wire at customer's service entrance, with indicated voltages for various positions of tester in relation to company and customer's wiring

If in any of the foregoing tests the grounded wire cannot be definitely and easily determined by the Wigginton tester, the 115-volt test lamp may be used. Where the ground connection is to a driven pipe or rod, one or two pails of water poured on the earth in the immediate vicinity will usually make it possible to get a test with the lamp; but if this test does not function, the ground must be left disconnected from the system and the meter engineer notified.

BE SURE OF *All* YOUR CONDUCTOR SUPPORT INSTEAD OF ONLY *Half* OF IT...





Support of a transmission line extends all the way from the conductor to the tower--the insulator string is one part, the hardware is the other. Both work together to do just *one* job.

Men who design O-B insulators and hardware likewise work together to do just one job. Here is the only place in the insulator industry where complete lines of both porcelain insulators and hardware are made "under one roof". Here is the only place where an over-all responsibility exists for all the factors that go into supporting a conductor. And, with that responsibility, goes the broader knowledge and experience that comes from dealing with *all* the problem instead of *half*.

When you build with O-B insulators and hardware, you are using a balanced combination that has proved itself conclusively for over a generation to be sound and practical. Specify your complete conductor support to be made by O-B; then you can trust *all* of it instead of *half* of it.

2654-H

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD.,
NIAGARA FALLS, ONT.

HEADQUARTERS FOR PORCELAIN INSULATION

Excitation Systems for Turbine Generators—II*

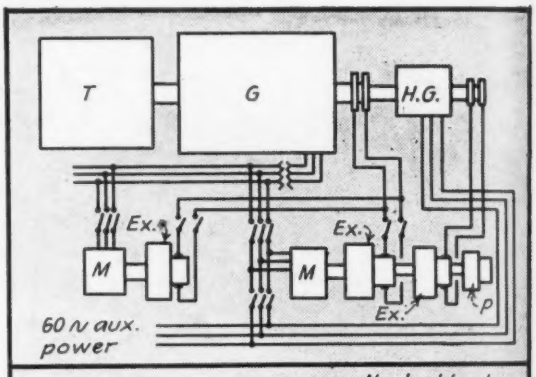
M. D. ROSS, *Manager, A. C. Generator Section, Westinghouse Electric Corp., East Pittsburgh, Pa.*

Comparative possibilities in regard to high availability, simplicity and low first cost of four of eight excitation schemes

A. SYSTEMS TAKING POWER FROM TURBINE SHAFT (Cont'd)

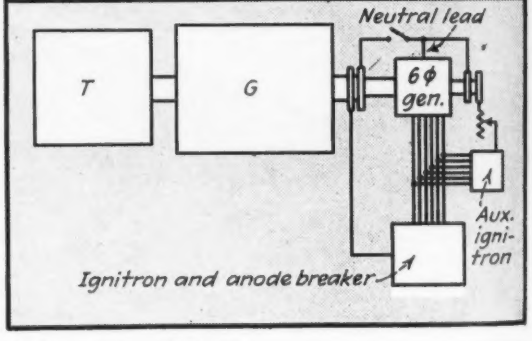
5. DIRECT-CONNECTED HOUSE GENERATOR

a. Installed cost higher than A-1 due to extra exciter for house generator, control, etc. Cost of house generator is not all chargeable to excitation scheme as it furnishes power for other auxiliaries.
b. Not affected by system disturbances.
c. Unless spare exciters are furnished brushes of both main and auxiliary m-g sets must be changed under load for continuous operation.
d. Requires outside source of power to get the motor-exciter unit started.
e. Exciter rheostatic regulator for main exciter direct acting type can be used for house generator.
f. A.c. auxiliary switchgear determined by reactance of house generator.
g. M-g set exciter can be designed for automatic transfer from auxiliary bus to house generator bus or vice-versa under load provided sufficient WR^2 is built into the set.



6. DIRECT-CONNECTED GENERATOR, 6-PHASE

a. Installed cost high due to special 6-phase generator and two ignitrons.
b. Not affected by system disturbances.
c. Tubes can be replaced under load, presumably no spare set required.
d. A battery is alternate excitation source when ignitrons are unavailable.
e. Uses direct acting or electronic regulator; speed of response very high.
f. Has added mechanical complications —coupling and two bearings over type B-2 (below).



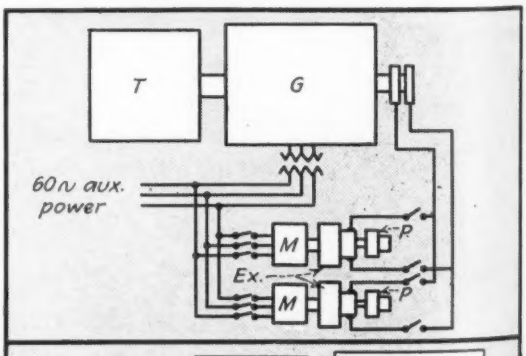
B. SYSTEMS TAKING POWER FROM MAIN GENERATOR

1. MOTOR-GENERATOR SETS

a. Installed cost slightly higher than direct-connected exciter.
b. Excitation is affected by dips in a.c. voltage. Interruption in a.c. power supply will cause rapid deceleration of the set.

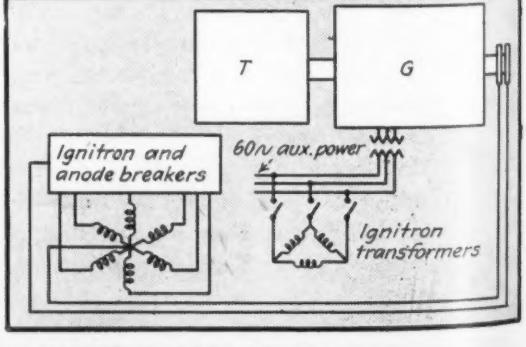
Stored energy of standard m-g set is about 2.0 kw.-seconds per kw. rating of set.

c. Unless a spare exciter is furnished, brushes must be changed under load for continuous operation.
d. Requires outside source of power to get unit started.
e. Direct acting regulator in smaller sizes. Larger sizes—exciter rheostatic regulator.
f. A.c. auxiliary switchgear determined largely by reactance of auxiliary transformer.



2. IGNITRON EXCITER

a. More expensive than direct-connected exciter.
b. While output voltage of ignitron exciter is affected by system faults, the effects of such faults can be largely compensated for by designing exciter for high ceiling voltage.
c. Tubes can be replaced under load. Presumably no spare set required.
d. Can be energized by battery to get unit started.
e. Uses direct acting or electronic type regulator—speed of response inherently high.



* *Concludes adaptation from a paper presented before A.I.E.E. winter convention, New York. For Part I see* ELECTRICAL WORLD, *July 6, 1946, page 102.*

STATIC-PROOF HARDWARE

Practical help in solving two important public utility problems is provided by Oliver Static-Proof Hardware.

Extensive investigations show that looseness between component parts of pole line hardware causes radio interference. This sometimes becomes a serious public-relations problem. Oliver Static-Proof Hardware has been designed to eliminate this trouble.

In addition, the use of this material reduces maintenance, because less attention and retightening is required. All along your lines, Oliver Static-Proof Hardware is a good investment.

Ask your Oliver representative about this important group of Oliver Pole Line Materials.

Full details are given in Oliver Catalog 43.

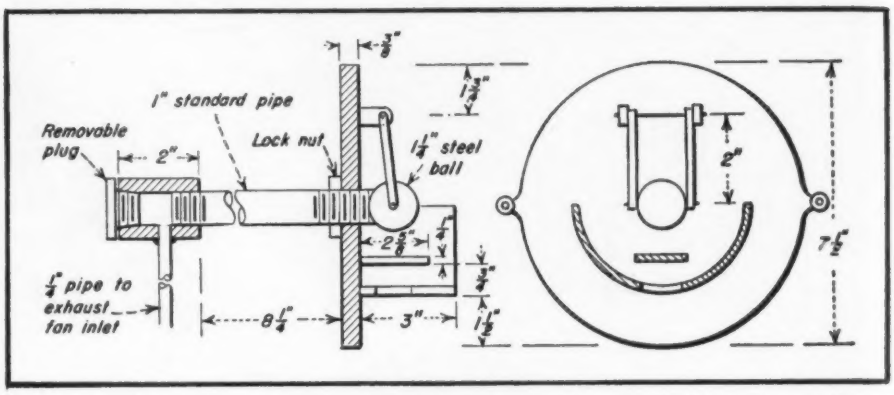
OLIVER
IRON AND STEEL
CORPORATION

SOUTH TENTH AND MURIEL STS. · PITTSBURGH 3, PA.

Clog-Proof Valve For Coal Sampler

THE ACCOMPANYING SKETCH shows the method used at Harding Street plant of Indianapolis Power & Light Co. to close off the port through which samples of powdered coal are removed for inspection. Formerly the sampling tube was inserted in the exhauster fan discharge through a pipe nipple and gate valve combination attached to an inspection-port cover plate. Pulverized coal had a tendency to clog the pipe nipple and the gate valve, making it difficult to open the valve and to close it again when opened.

This difficulty has been overcome with the ball-type valve arranged as shown on the inside of the inspection-port cover plate. Since a small amount of coal leaks past the ball valve, an enclosure has been built around the outboard end of the coal sampler and a ¼-in. pipe led down to the suction side of the exhauster fan. In this way any powdered coal that leaks past the valve is automatically drawn back into the fan, avoiding clogging.



BALL VALVE closes inboard end of pipe nipple through which coal sampling tube is inserted in exhauster fan discharge. Enclosure and suction line returns coal that leaks past valve to suction side of the fan

• • •

Germans Used Synchronous Contact-Type Rectifier

A CONTACT RECTIFIER for converting alternating current into direct current was developed and used successfully on a small scale in Germany during the war, according to a report by the Department of Commerce.

Commercial advantages claimed for the rectifier are:

(1) It exhibits higher electrical efficiencies than mercury vapor rectifiers, rotary converters, and motor generators.

(2) It will operate on 30 volts or lower, where mercury vapor rectifiers are incapable of functioning.

(3) It is considerably lighter in weight than other rectifiers with equivalent capacities and ratings.

The new rectifier was developed by the Siemens-Schuckertwerke at Berlin. The change in direction of the alternating current is effected by silver-tipped copper contacts that are opened and closed at the proper moment, and in the proper sequence, by a revolving camshaft driven by a synchronous motor. The motor is powered by same a.c. circuit with which the rectifier is used.

The report was prepared by L. C. Turnock for the U. S. Chemical Warfare Service.

Network Signal Light

INDICATING when the switch is in open position, a 25-watt, 130-volt signal lamp is used on all network protectors of Oklahoma Gas & Electric Co. This lamp is located in a vault ventilator where it is readily visible from the street above and is controlled by an auxiliary switch on the protector, which closes the lamp circuit when the protector opens.

• • •

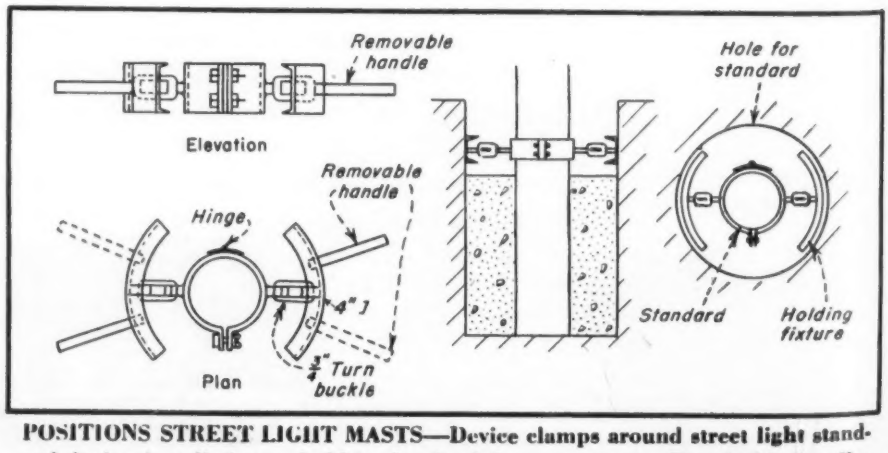
Set Lighting Standards With Positioning Jig

D. E. LUCKEY

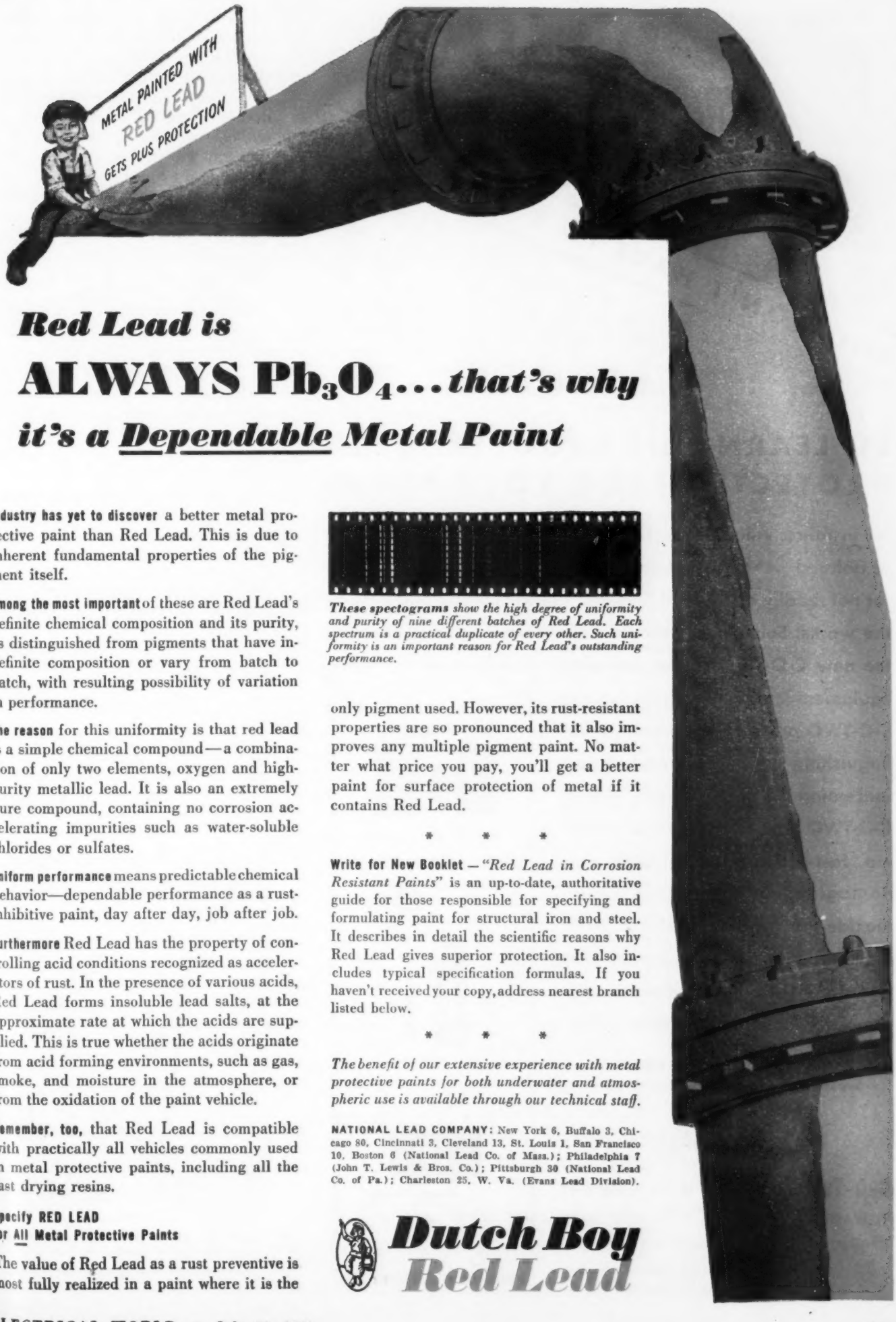
Engineering Dept.
Texas Electric Service Co.
Fort Worth, Texas

ONE OF THE TRICKS of installing ornamental street light fixtures lies in finding a way to hold the mast until concrete around its base can set. This usually takes 24 hours and requires the use of cumbersome guys, braces or other impediments to traffic.

A much less complicated procedure was used by the Texas Electric Service



POSITIONS STREET LIGHT MASTS—Device clamps around street light standard during installation to hold it plumb while concrete sets. Detachable handles permit easy positioning of standard in hole



Red Lead is
ALWAYS Pb_3O_4... *that's why*
it's a Dependable Metal Paint

Industry has yet to discover a better metal protective paint than Red Lead. This is due to inherent fundamental properties of the pigment itself.

Among the most important of these are Red Lead's definite chemical composition and its purity, as distinguished from pigments that have indefinite composition or vary from batch to batch, with resulting possibility of variation in performance.

The reason for this uniformity is that red lead is a simple chemical compound—a combination of only two elements, oxygen and high-purity metallic lead. It is also an extremely pure compound, containing no corrosion accelerating impurities such as water-soluble chlorides or sulfates.

Uniform performance means predictable chemical behavior—dependable performance as a rust-inhibitive paint, day after day, job after job.

Furthermore Red Lead has the property of controlling acid conditions recognized as accelerators of rust. In the presence of various acids, Red Lead forms insoluble lead salts, at the approximate rate at which the acids are supplied. This is true whether the acids originate from acid forming environments, such as gas, smoke, and moisture in the atmosphere, or from the oxidation of the paint vehicle.

Remember, too, that Red Lead is compatible with practically all vehicles commonly used in metal protective paints, including all the fast drying resins.

Specify RED LEAD
for All Metal Protective Paints

The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better paint for surface protection of metal if it contains Red Lead.

***These spectograms** show the high degree of uniformity and purity of nine different batches of Red Lead. Each spectrum is a practical duplicate of every other. Such uniformity is an important reason for Red Lead's outstanding performance.*

* * *

Write for New Booklet — "*Red Lead in Corrosion Resistant Paints*" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

* * *

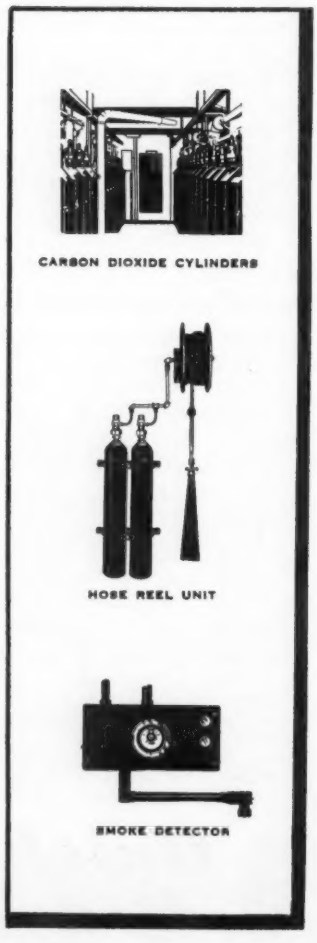
The benefit of our extensive experience with metal protective paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6, Buffalo 3, Chicago 80, Cincinnati 3, Cleveland 13, St. Louis 1, San Francisco 10, Boston 6 (National Lead Co. of Mass.); Philadelphia 7 (John T. Lewis & Bros. Co.); Pittsburgh 30 (National Lead Co. of Pa.); Charleston 25, W. Va. (Evans Lead Division).

Dutch Boy
Red Lead

TO LEARN THIS ABOUT MODERN PROTECTION FOR YOUR PLANT

For instance: valuable records, tracings in vaults or warehouses in isolated, seldom visited spaces could be the starting points for not readily discovered fires that quickly spread and destroy the works. Such spaces should be protected against fire with the new C-O-TWO smoke detecting equipment combined with the famous C-O-TWO pressure operated fire extinguishing system. To quickly detect and extinguish fires in modern plants, C-O-TWO now offers this new, modern, fast-action detection with non-damaging, non-conducting carbon dioxide gas for extinguishing. Without obligation C-O-TWO engineers will confer with you about modern fire protection for your plant. Write today.



C-O-TWO Detects Smoke — Kills Fire Saves Lives and Property. It's Modern

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C-O-TWO FIRE EQUIPMENT COMPANY

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AFFILIATED WITH PYRENE MANUFACTURING COMPANY

Sales and Service in the Principal Cities of United States and Canada

Co., Fort Worth, recently in installing standards for mercury street lights at Grand Prairie, Texas. The Southern Ornamental Iron Works, Arlington, Texas, who supplied the standards also devised a special fixture, shown, for setting, straightening and holding the standards during erection.

The device consists simply of a split hinged collar that can be clamped around the pipe-type lighting standard. This collar is connected by turnbuckles to two outer circular segments of 4-in. channel provided with fittings for attaching removable handles.

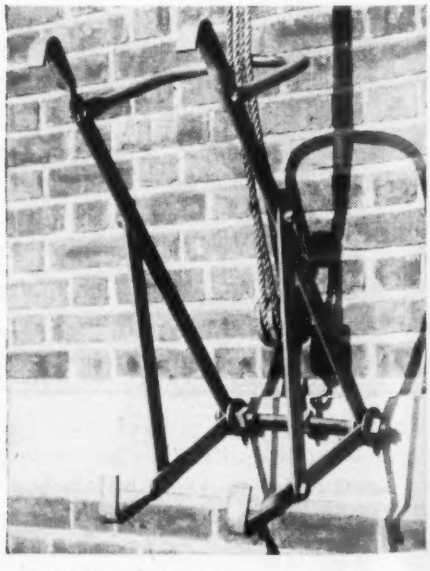
With the collar bolted to the lighting standard, the handles may be used to lift or turn the standard to position it in the hole. When the standard is plumb the handles are removed from the fitting and the turnbuckles adjusted until the channel segments bear firmly against the sides of the hole, holding the standard plumb and in the center of the hole until the concrete can be poured and set.

Four men and a derrick truck fitted with an earth auger set the standards at Grand Prairie using this device. In no case was it necessary to guy the standards while the concrete set.

•

Grid Lifter Aids Metering Installations

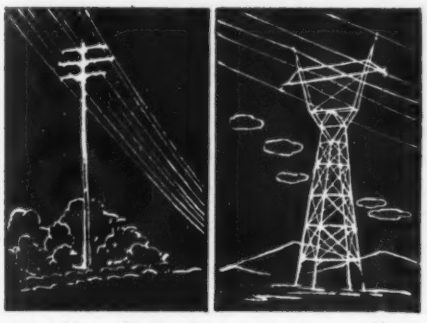
A DEVICE known as a grid lifter has been developed to hoist prefabricated grid assemblies or instrument transformer mounting frames to outdoor metal cabinets on poles. This lifting



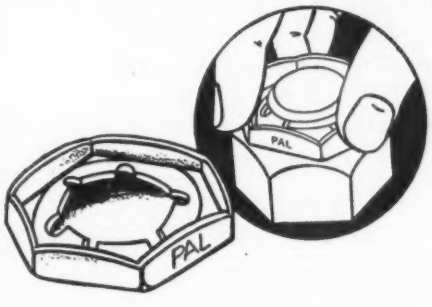
FRAME and block and tackle are used to lift a preassembled grid of instrument transformers for installation in cabinets on poles

ELIMINATE RE-TIGHTENING OF NUTS

On Steel Tower and Wood Pole Lines



Specify Palnuts on new lines
Add Palnuts to existing lines



For over 10 years, Double Locking Palnuts have been keeping bolt-and-nut assemblies tight on steel towers, wood pole lines, cross arms and braces, insulator pins, clevises and clamps.

When applied on new installations, Palnuts save future check-ups and re-tightening. Maintenance crews checking old installations can add Palnuts without disturbing regular nut. Only 3 bolt threads space are required. Palnuts are very low in cost; may be removed and reused. They are available in a full range of sizes, in Hot Dipped Galvanized or other finishes and materials used by the Utility industry.

SEND details of your needs for samples. Write for Palnut Manual No. 1 and detailed folder on power line applications.

THE PALNUT COMPANY
51 Cordier St.,
Irvington 11,
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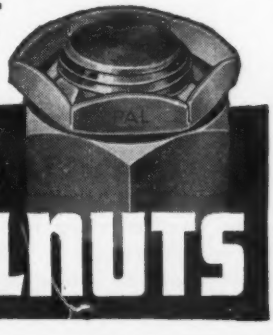

DOUBLE-LOCKING PALNUTS

BERMICO*

FIBRE CONDUIT

FOR SUREST CABLE PROTECTION---
SPECIFY BERMICO CONDUIT

1 **LIGHT.** Easily handled on the job; one man can carry several 8-foot lengths at once—lay more per working hour.

2 **TIGHT.** All joints are precision milled for tight, speedy, installations.

3 **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.

4 **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.

5 **WATER PROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.

6 **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.

7 **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!

8 **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.

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Offices in all leading cities

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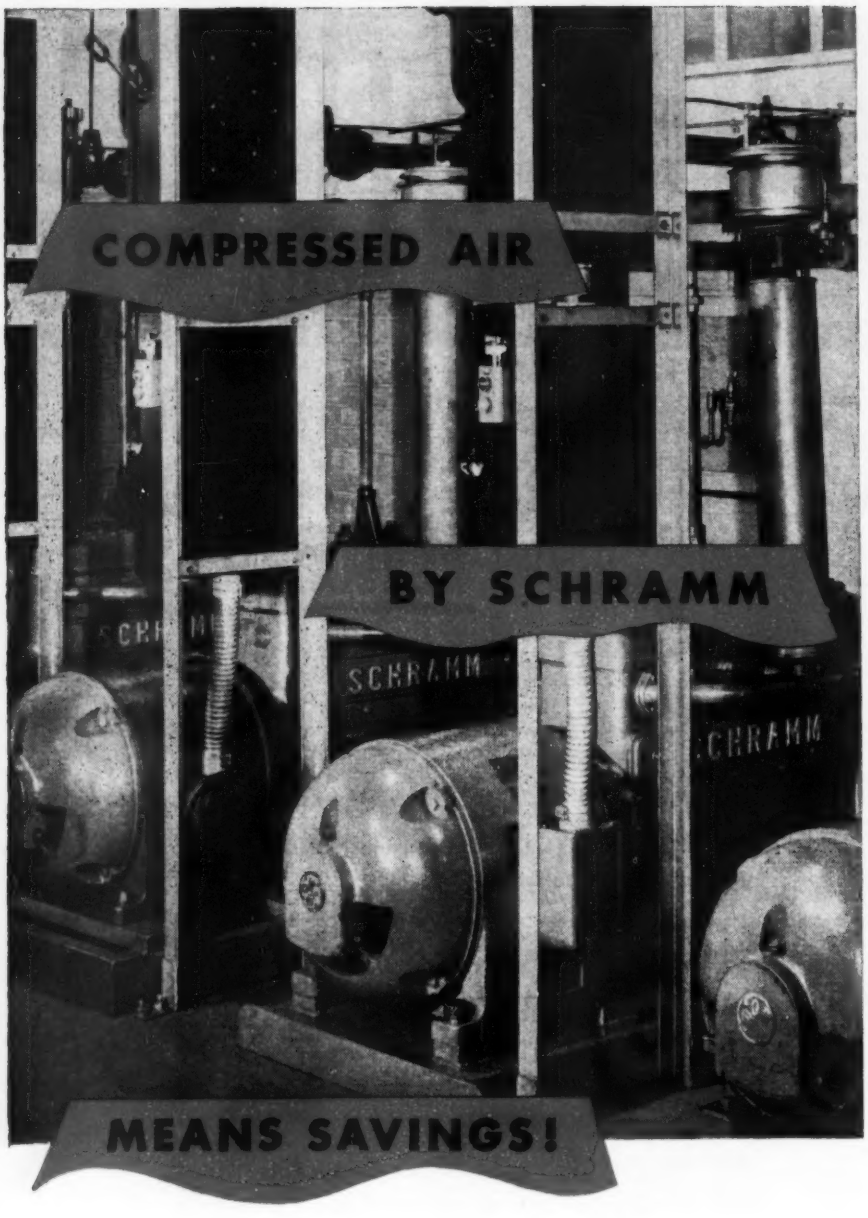

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SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

device as illustrated is constructed primarily of ¼-in. by 1-in. flat strip steel. It facilitates primary metering installations of the Philadelphia Electric Co., as outlined in "Lightning Protection for Primary Metering Cabinets" by Robert Pfaff and H. N. Ekvall in ELECTRICAL WORLD, April 13, 1946, page 110.

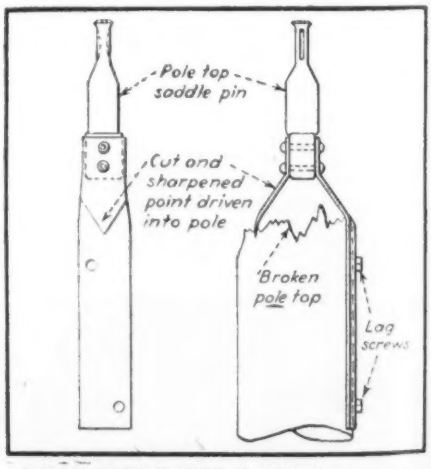
The grid is a standardized frame 47 in. by 37 in. and mounts indoor type current and potential transformers and standard color code secondary wiring with terminal block, all assembled as a unit in the company's shop. The preassembled unit is set on the lifter and raised by block and tackle to a position for entrance to the cabinet.

•

Emergency Repair
Pole-Top Saddle Pin

ON WOODEN pole lines using saddle type pins at the top of the pole in triangular construction, burns or breakage of the pole near the top frequently make it impossible to temporarily reinstall the saddle pin. To overcome this difficulty, Reginald Knaggs and Holly Hough of the California Electric Power Co., Riverside, Calif., modified a few of these pins to serve in such emergencies.

As shown by the accompanying sketch, one side of the lower saddle portion was cut off and sharpened to a point. This point can be driven into the jagged pole top and the other side of the saddle fastened to the pole with lag screws. This makes an entirely satisfactory temporary pole-top insulator pin. It has been found that these pins can be installed in one-fourth



POLE-TOP SADDLE PIN for emergency repairs when top of pole is burned off is made by cutting off and sharpening one side of lower portion on supporting bracket

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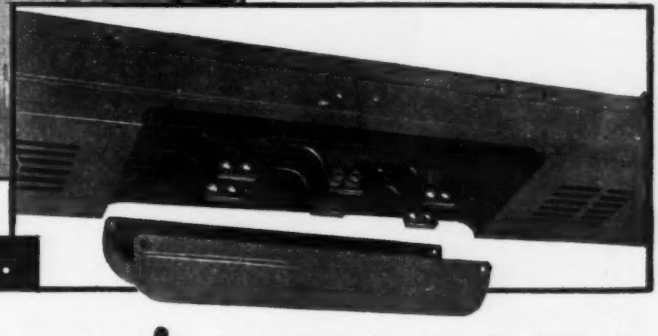
"Like a broad and safe Electrical Highway through the plant"



The new improved type connection and cover simplify installation . . . no special tools required. Cover quickly removed for inspection . . . lots of room to work. Now easier than ever to take off taps from L.V.D. Systems.

. . . and easy to get . . . NOW!

If you are an electrical contractor, an architect, utility man, or industrial electrical engineer, here is something really important you can do for your customers or clients. Tell them about Trumbull's COMPLETE modern method and equipment for industrial and commercial power transmission and control . . . about Trumbull L.V.D. Busways for main feeder distribution . . . Flex-A-Power Plug-in Busways and Flex-A-Plugs for branch circuits to load, and Trumbull Control Centers for flexible, complete motor control and feeder circuits Trumbull pioneered these basic systems. Trumbull engineering has brought them to their present high pitch of efficiency. And Trumbull production makes them available to you NOW in packaged units ready to install and connect.

If you are an industrial plant owner or operator faced with urgent need of procuring electrical power distribution equipment, call the nearest Trumbull Electrical Contractor right away, or write direct to Plainville.

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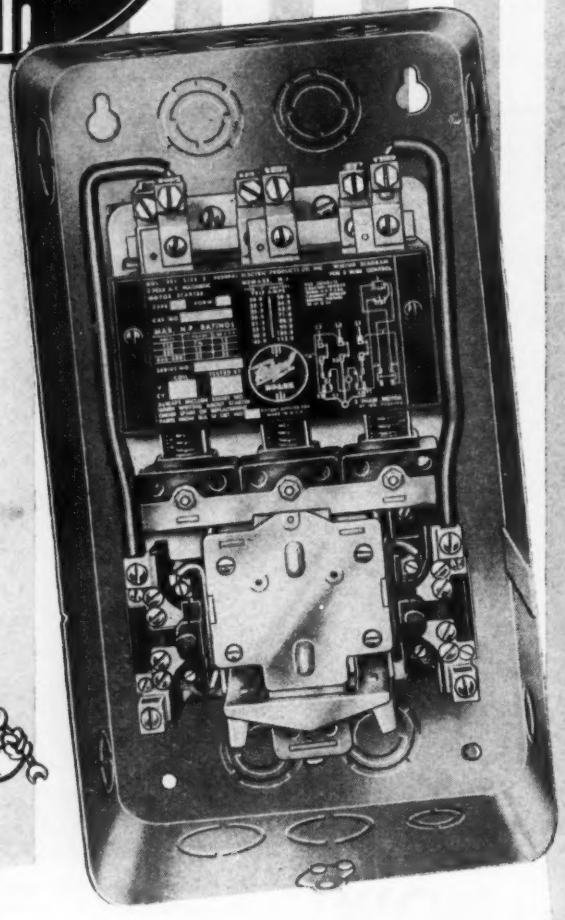


For man-size jobs of stop-and-go
Without a bit of care or woe
This starter really fills the bill . . .
A fine example of Federal's skill!

Sets a new standard of ease and speed in replacement of any stationary or moveable contacts. Coil replacement in a few seconds without disturbing line or load connections. Greater compactness, yet more ample wiring space. Silver contacts on all current interrupting points. Exclusive vertical ball-bearing operation for highest speed solenoid action. Overload relays, combination hand or automatic reset, for dependable protection.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. PLANTS: HARTFORD, CONN. NEWARK, N. J.

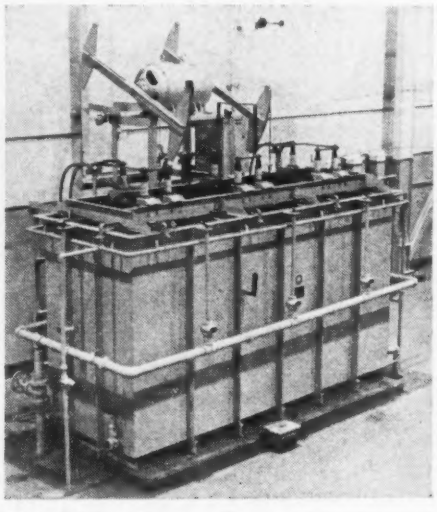
the time previously required to reform the pole top with a hand axe and install a conventional pin.

•

Liquid Slip Regulator Helps Control Power

A LIQUID slip regulator prevents frequent high peak loads being imposed on the main power supply lines at the Fontana, Calif., steel plant of the Kaiser Co., Inc.

In the plant a 36-in. reversing roughing mill is driven by a 5,000-hp. d.c. reversing motor which is supplied from a 5,000-kw. flywheel motor-generator set. The set is driven by a 4,500-hp.,



LIQUID slip regulator in motor room prevents frequent high peak loads on main power line at steel mill

6,600-volt, 3-phase, 50-cycle, 490-rpm., wound-rotor induction motor with an automatic liquid slip regulator in the secondary circuit. The regulator is so adjusted that it permits the flywheel motor-generator set to slow down whenever a peak load comes on. Thus the flywheel gives up some of its energy and absorbs part of the peak.

•

Transposed Load Curves

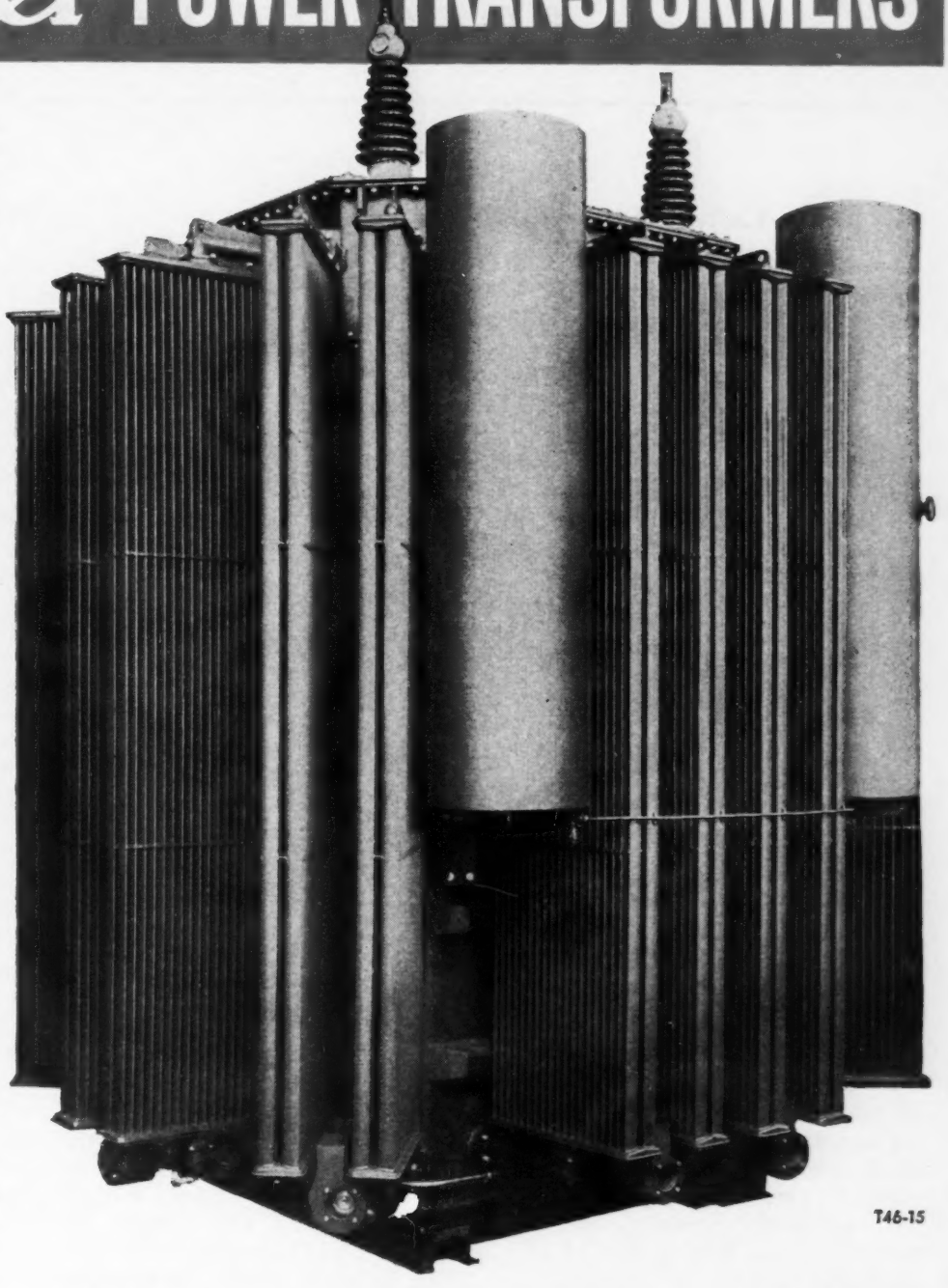
ATTENTION of the editor has been called by H. C. Powers, Superintendent, Tell City Electric Dept., Tell City, Indiana, to an inadvertent transposition of graphs in the Engineering Reference Sheet on page 100 in the January 5, 1946, issue of ELECTRICAL WORLD. The title was "Load Curves for Conductors on Low-Voltage Distribution Circuits." The upper diagrams should be interchanged in order to jibe with the captions (Fig. 1 and Fig. 2).

Wagner POWER TRANSFORMERS

Wagner power transformers are representative of the very latest improvements in transformer manufacture. The transformer here illustrated is typical of Wagner design and manufacture, embodying all the latest developments in transformer engineering—designed to give many years of dependable, low-cost service.

It is rated 20,000 kva self-cooled and 25,000 kva forced-air-cooled, one of a bank of single-phase 72,000—to 12,700-volt transformers recently built for a large utility.

Wagner builds a complete line of distribution and power transformers, completely described in Bulletins TU-180 (Distribution) and TU-181 (Power). Wagner Electric Corporation, 6456 Plymouth Avenue, St. Louis 14, Missouri.



T46-15

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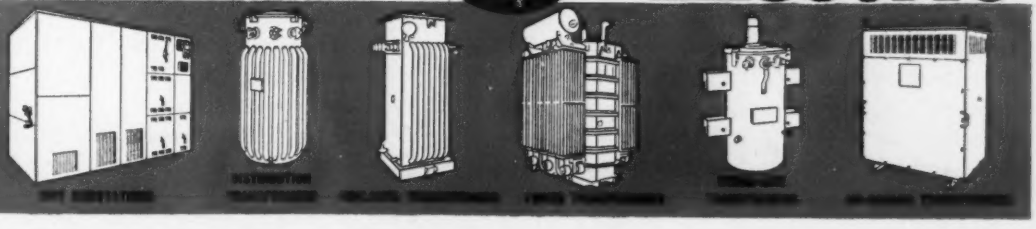


LOAD BUILDING

Coffee House Load Offers Diversity

George B. Meyers, Inc.

COUNTER and back bar of electrified restaurant

VAN DYK COFFEE HOUSE, for many years a Main Street landmark in Hartford, Conn., recently expanded its use of purchased energy from 828 kw.-hr. per month to 10,000, its demand rising at the same time from 3 kw. to 31. About 90 percent of the equipment is now electrically operated, the connected load now totaling 60.8 kw., including lighting, 6.6 kw.; refrigeration, 4.5 kw.; miscellaneous motors, 1.75 kw.; and heating applications, 48.2 kw. Hartford Electric Light Co. supplies the service, which has the advantage of long-hour use, including soda fountains and back bar items, lunch counter, sandwich bar, booths and coffee and tea sales counter. Load-factor is about 60 percent.

Principal lighting facilities include thirteen 200-watt Litecontrol fluorescent units and six R40 150-watt floods recessed in ceiling, for general illumination (average intensity about 30 foot-candles); fifteen 100-watt lamps in recessed window reflectors; neon sign, 1 kw.; back bar lighting, 600 watts (twelve 40-watt fluorescents and strip lighting). Refrigeration motors total seven, ranging from ¼-hp. to 1-hp. rating. General power motors include 1 hp. for dishwashing; a ½-hp. carbonator and a ¼-hp. glasses washer. Heating units and their wattages include: Two food warmers, 3,800 and 5,300; Griswold griddle, 6,000; Griswold fryer, 4,000; second Griswold fryer, 12,000; 4-slice toaster, 2,500; waffle baker, 1,400; roll warmer, 1,000; 2-slice toaster, 1,000; dishwasher, 5,000; glass washer, 500; fudge warmer, 600; mixer, 1,000; 2-burner Silex, 1,400; two more fudge warmers, total 1,200; waffle baker, 1,500.

The house is open from 6 a.m. to midnight and serves about 75,000 persons each month. The electric service bill, about $300 per month, the management states, approximates but 5 percent of the total running expenses, and the use of electricity speeds up service all along the line.

Notes on Design of Mow Hay Driers

A. A. PFINGSTEN
Rural Development Engineer
Wisconsin Public Service Corp.
Green Bay, Wis.

BENEFITS of mow hay curing may be briefly summarized as follows:

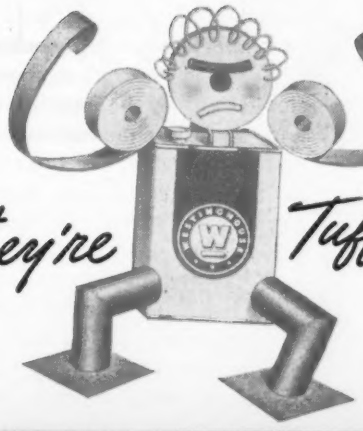
1. Improved product and more hay in the mow per acre cropped. Estimates at today's prices are that farmers storing over 40 tons per year can pay for a hay-drying installation in its first three years' use.

2. It is labor saving. Studies show 3.6 manhours per ton are required from windrow to mow by the side delivery hay loader method; 2.7 manhours per ton by field baler method; 2.4 manhours per ton with buck rake and 1.2 manhours per ton when a field chopper is used.

3. It prevents fires from over heated hay. Looking into the future it is possible to foresee that mow cured hay will replace or supplant some of the grains and fodder corn as dairy feed to a substantial degree.

Cost of a hay-drying installation ranges from 30 to 45 cents per square foot of mow space if one-third of the motor cost is allocated hay curing. This is done as the motor may be used for some other jobs about the farmstead. Electricity cost for complete curing runs from $0.75 to $1.85 per ton on rural rates charged by this company.

Design and construction of a mow hay-drying installation is not difficult. Several rules should be observed, however: (1) The mow floor must be air tight; (2) Blower capacity of 15 cfm. for each square foot of mow floor area is required; (3) Use ¾-in. static air pressure blower for hay depths under 12 ft., 1-in. static air pressure blower for hay depths of 12 ft. to 22 ft. (4) Provide a 4-ft. high main air tunnel for hay depths to 12 ft.; 6-ft. tunnel height for 12 to 18-ft. hay depths. (5) Select tunnel width to give air velocity of 1,000 ft. per min. Thus tunnel area in sq. ft. is given by dividing blower capacity in cfm. by 1,000. Required



"They're Tuffernell"

VARNISHES · FABRICS · PAPERS · MICAS

. . . and FIBERGLAS!

TAPES
For field and armature coils of motors; coil wrappers for aircraft electrical equipment; bus bar wrappings; industrial control coils; underground mine cables.
TYING CORDS
For banding field coils; wrapping string bands on small armatures; protecting front of commutator V-ring on some types of motors; banding on V-ring extension on some d-c equipment; reset strings; tying slot insulation in place; lashing ends of coils in large motors and generators.
SLEEVING
For coil leads, interconnectors, transformer leads; often used over cotton or enameled wire on d-c armatures for the coil leads from the slots to the commutator.

The Tuffernell line includes a *complete selection* of Fiberglas tapes, tying cords, sleeving. Illustrated here are coils wrapped with Fiberglas tape.

Fiberglas is an *exceptional* member of the Tuffernell line of insulating materials...it offers...

- greater **HEAT PROTECTION . . .** added protection against higher temperatures when an overload occurs.
- greater **MOISTURE RESISTANCE . . .** glass fibers do not absorb moisture.
- greater **SPACE ECONOMY . . .** less Fiberglas is required to obtain the proper insulation protection.
- greater **DIELECTRIC STRENGTH . . .** tests prove that properly impregnated Fiberglas has higher dielectric strength than most other varnished textiles.

These advantages have been proved by the increasingly extensive use of Fiberglas in the electrical industry.

Call your nearest Westinghouse office for complete information about Fiberglas products and others in the Tuffernell line. Ask for an insulation specialist. He'll be glad to help you. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-06391

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PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INSULATING MATERIALS

Everybody likes a-

CHAMPION...

-and that goes for

CHAMPION

Fluorescent and *Incandescent*

LAMPS

The *worker* in shop and office likes them because CHAMPION Lamps *make light work*. They have the uniform quality of illumination and lasting dependability in service that comes only from years of specialization in the manufacture of lamps for industry. They are guaranteed to equal or exceed Federal Specifications.

The *buyer* likes them because the Champion manufacturing and distribution set-up is concentrated on getting the most lighting and the most lamp value for his money. Champion Lamps for industry mean minimum lighting cost as well as lamp cost.

The *manager* likes them because of Champion's efficient field service, trained lighting experts always available and cooperating with a selected industrial distributor near the plant to assure dependable assistance on every lighting problem.

***You'll* like them, too. Try CHAMPION Lamps and Champion Lamp service. Let us put you in touch with your nearest Champion source of supply.**

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

tunnel width is found by dividing area by tunnel height for given hay depth.

As the mow size and amount of hay stored varies, the size of the blower and some of the other factors will necessarily vary. A typical layout is for a 30 by 40-ft. mow floor on which hay will be stored 18 ft. deep. Long or chopped hay may be stored but long hay requires about 500 cu. ft. of mow space per ton, whereas chopped hay requires only 350 cu. ft. per ton. Either long or chopped hay may be laid down when moisture is 30 to 35 percent. Such an installation will require a blower capable of delivering 18,000 cfm. at 1-in. static pressure and require about a 5-hp. motor. Main tunnel height will be 6 ft., width 3 ft.

Blowing time will run from 5 days to 3 weeks depending on the weather conditions and the moisture of hay in the mow. Blowing should not be stopped at night or on foggy days because of fear that the moisture laden air may dampen the hay. The blower should be kept running continuously until curing is completed. This condition obtains when temperature of hay approximately 4 ft. below the surface is equal to that of the air 3 or 4 ft. above the surface. If hay temperature is lower than air temperature blowing must be continued. Lower temperature of the hay indicates that moisture is still present and is being evaporated from the hay, lowering its temperature.

What happens when power interruptions occur? Power service interruptions during the daytime generally are not more than 3 or 4-hours duration. If they occur after midnight, no harm is done. Tests show that somewhat more than 20-hours time must elapse before heating to the ignition point takes place. Ignition temperature of hay is about 480 deg. F. No fires are known to have occurred in the 50 installations in Wisconsin or the 700 or more over the nation.

•

To Speed Sales of Commercial Cooking

METHODS of developing sales of commercial electric cooking equipment through closer cooperation between kitchen supply houses, power companies and manufacturers featured a recent meeting of the Power Engineers Association of New England in Boston during an off-the-record discussion of this phase of load building. During the recent war, domination of the market

WHERE DEMANDS ARE HEAVIEST...

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UTILITY BODIES

do the work more efficiently!

Good functional design, so essential to efficiency, is built into every POWERS Line Construction and Maintenance Body. Experienced engineering, plus an intimate knowledge of line work requirements, balances strength with weight, accessibility with compact tool capacity and efficient arrangement. For utility bodies of dependable quality and proved designs to fit your individual needs, write today for bulletin and quotation form.

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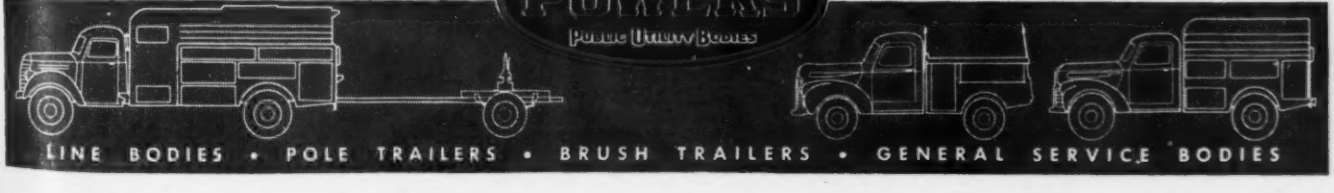
ALL-STEEL POWERS Public Utility Bodies

5900 NORTH BROADWAY, ST. LOUIS 15, MO.



LINE BODIES • POLE TRAILERS • BRUSH TRAILERS • GENERAL SERVICE BODIES

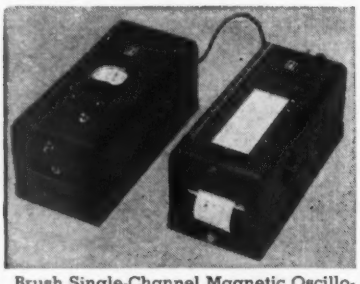
Brush Magnetic Oscillographs

make direct-writing recordings from D.C. to 100 cycles per second!

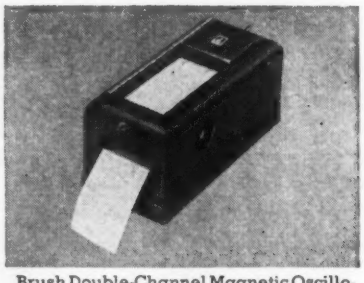
The remarkable new Brush Magnetic Recording Pen Motor—heart of the Brush Direct-Inking Oscillograph. Highly stable. May be used under virtually any climatic or temperature conditions. Exceptional accuracy.

● *Instantaneous, permanent, ink-on-paper* recordings by Brush Oscillographs make their use almost unlimited. Accurate recordings of strains, pressures and countless electrical phenomena can be made over a frequency range of *D.C. to 100 c.p.s.* Either A.C. or D.C. circuits can be measured. Whenever desired, recordings may be stopped for notations on chart-paper.

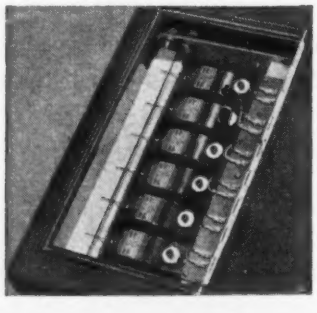
Brush Oscillographs are compact, portable and ruggedly constructed for ease of handling and operation. Investigate them now. Brush engineers will gladly co-operate in determining their application to your problems. Write for technical bulletin No. 593 for complete details of this equipment.



Brush Single-Channel Magnetic Oscillograph with amplifier. Especially suited for counting, temperature recording, surface analysis—and similar applications. Three-speed paper drive, 5, 25, 125 mm per second. Chart paper 2⅜" wide.



Brush Double-Channel Magnetic Oscillograph for use where two simultaneous recordings are desired—as in synchronizing problems. Three-speed paper drive, 5, 25, 125 mm per second. Chart paper 3 15/32" wide.



Brush Six-Channel Magnetic Oscillograph. Excellent for strain-gauge recordings. Dust-proof case. Interchangeable gear paper drive. Your choice of paper speeds from ⅛" to 5" per second. Chart paper 12" wide.

THE BRUSH DEVELOPMENT CO.

3405 PERKINS AVENUE • CLEVELAND 14, OHIO

Canadian Representatives: **A. C. Wickman, (Canada) Ltd., P. O. Box 9, Station N, Toronto 14**

for electric cooking apparatus by the government for the benefit of the armed forces greatly handicapped promotion and sales of heavy duty equipment, and recent strikes combined with shortages of material and manpower have hampered recovery of this class of business. It was pointed out that some kitchen supply houses are now putting sales forces into the field who lack information as to the design and application of commercial electric cooking equipment, although in some cases makers of fuel-burning equipment are vigorously promoting the sale of their products by laying the educational groundwork for installations as fast as this product becomes available.

Prevents Interruptions

Users of commercial electric cooking equipment emphasize the great value of inspection and servicing to prevent interruptions of production during peak load and other hours. More frequent contacts between manufacturers' representatives and the owners and operators of such installations were cited as essential, although the well known advantages and high reliability of electric cooking are recognized and appreciated by restaurateurs. It has been found that where intensive field work is carried on, with close cooperation between kitchen equipment and cooking apparatus manufacturers and local power sales organizations, the prospects of successful competition against gas and oil-burning equipment are greatly improved.

Contact The Utility

In this connection it is urged that representatives of kitchen supply houses make a point of calling upon power sales departments of local utilities whenever such men are looking up or following prospects in local areas. This gives the utility commercial cooking promotion forces the welcome opportunity to aid the field men of the hotel and restaurant equipment houses in dealing with utility customers and explaining rate applications, service requirements and comparing experience with electric cooking elsewhere. It also helps bring about a closer cooperation between electric range, fry kettle, bake oven and other commercial cooking apparatus manufacturers and the sellers of hotel and restaurant equipment. The power company's main objective is load building through the use of the best available equipment and methods, and the present lack of information re-

BARS require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.
TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.
CHANNELS have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.
ANGLES for ventilated hollow busses have highest rate of heat dissipation, handle greater current density, but require more space for installation.
CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as furnaces of the arc or resistance types.

Copper Tubes

FOR HIGHEST A. C. EFFICIENCY...

TUBULAR shapes offer the lowest impedance to the flow of alternating current. Watt losses are accordingly low by comparison with other conductor shapes.

Greater rigidity . . . the possibility of increasing current capacity by water or oil cooling . . . comparatively low corona discharge at high voltages . . . are other advantages offered by tubular conductors.

In this as in other shapes, copper is generally recognized as the most satisfactory bus material. For in addition to high electrical and thermal conductivity, copper provides strength, toughness and corrosion resistance.

For detailed information on the range of sizes and shapes in which Anaconda Bus Conductors are furnished, write for Publication C-25.

68148

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from mine to consumer

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Anaconda BUS CONDUCTORS

Recently we had an illustration of how much self-supporting aerial cables save over open wire. One of our customers planned to put in a 13 k.v. open wire feeder. In order to get it installed it would have been necessary to go around a town which would have taken 16 miles of open wires. By changing the specifications to Simplex self-supporting aerial cable it was found possible to do the same job with only 2½ miles of line. The saving in this case amounted to a good many thousand dollars because the poles, cross-arms, pins, insulators, line hardware, etc., that were necessary for the 16-mile line did not have to be bought and installed. Instead, the 13 k.v. line, because it was insulated, was suspended from existing pole lines.

Before you plan any type of open wire construction, investigate Simplex aerial cables and see how much you can save on your installation. Simplex aerial cables are dependable, make good looking installations and cost much less to put up in both dollars and man hours, besides a very considerable savings in right-of-way, pole lines, and hardware.

Simplex-WIRES & CABLES

SIMPLEX WIRE & CABLE CO. 79 SIDNEY ST. CAMBRIDGE 39, MASS.

ported by some hotel supply sales forces as to electric cooking is being effectively overcome where the latter field men maintain frequent contacts with the electric utilities' sales organizations.

Cooperation Likely

Alert manufacturers are sensing the importance of this lack of knowledge, especially on the part of young salesmen of kitchen equipment houses recently back from war service; and as material and labor conditions permit, closer cooperation is likely to develop. Power sales forces of utilities, or whatever departments of such companies promote commercial cooking, stand ready to further this cooperation to the limit of their capability.

•

Electric Fan Can Build Domestic Load

THE ELECTRIC FAN can be a helper around the house, not just something to use in the hot weather for comfort. N.E.M.A. electric fan section is bringing this idea of larger use of the fan to the attention of Mrs. America and it can profitably be included in the load-building activities of home-service workers of electric utilities.

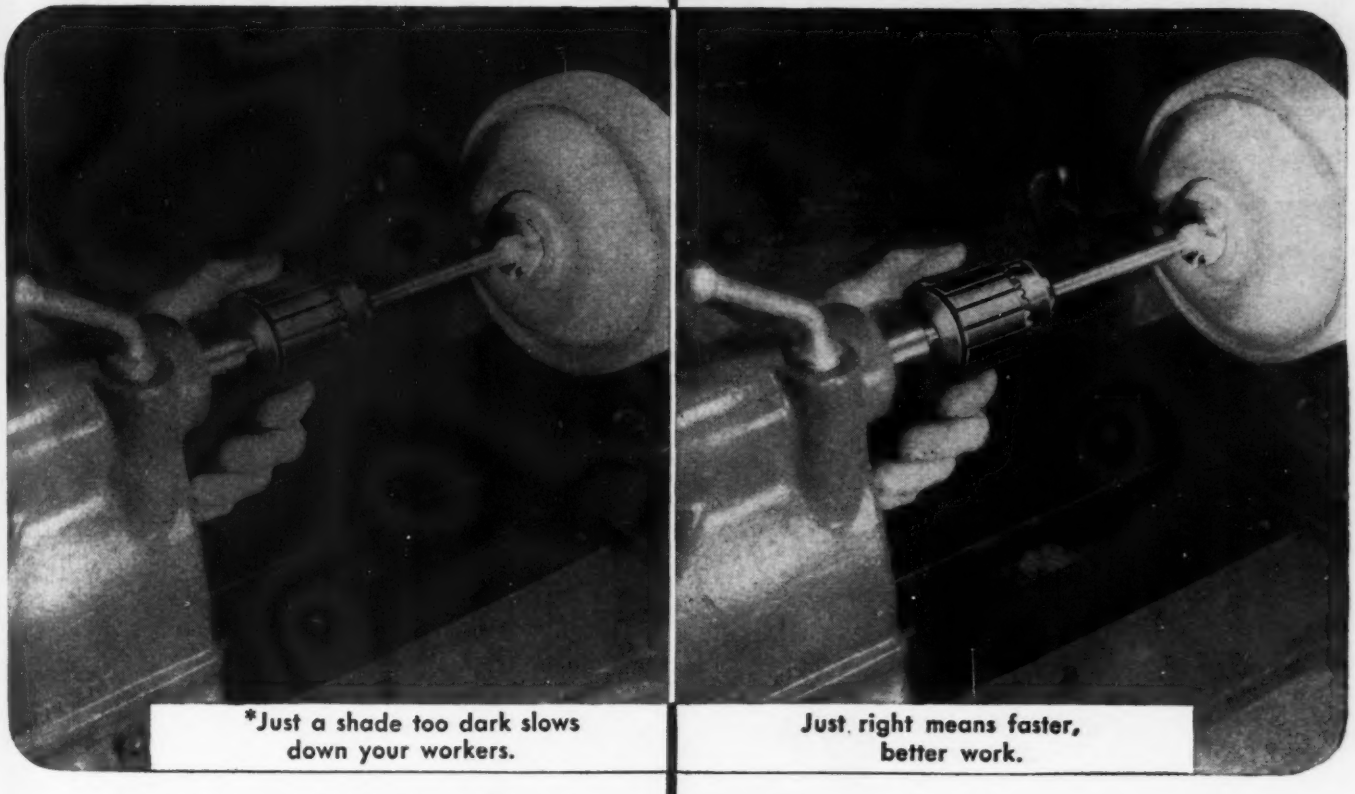
In the spring house-cleaning the fan is a real help. After the floors have been scrubbed, the fan will dry the surfaces quickly. This has a double advantage because dirt and dust does not stick to the dry floor as readily as to the wet. Other suggested uses for the fan are:

1. After cleaning the cellar or attic, it will clear out odors, discourage moths, mice and such. It will remove cigarette and stale beverage odors from the rumpus room quickly.
2. Make the house more livable by drying paint, varnish or wallpaper quicker by circulating the air.
3. Dry the freshly painted screens, allowing them to be painted and put on in one day.
4. Eliminate the necessity of waiting for a breezy day before winter clothes can be properly aired previous to retiring them for the season.
5. Quickly removes unpleasant odors from commercially or home dry-cleaned clothes.

All of these suggestions are made to prove that the fan is a multi-purpose home appliance and should not be considered as a one-job instrument.

BORDERLINE VISION*

May be hampering production in your plant!



*Just a shade too dark slows down your workers.

Just right means faster, better work.

Eliminate lighting handicaps with Wheeler Skilled Lighting

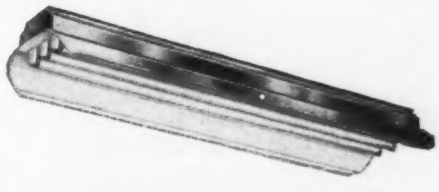
THE LIGHTING in your plant may *look* all right at a glance, yet be just a shade too dull or too bright in some places. Watch out!

That may mean that some workmen need two-looks-to-make-*sure* – and waste time. Or that they take chances on one look – *and rejects.* In either case production is hampered and costs go up!

Better work and reduced costs are practically automatic when you install evenly distributed shadow-free light, with efficient Wheeler Reflectors. Product of 64 years of specialized lighting experience, they are engineered to get maximum illumination *from standard lamps;* to stand up longer; to require less maintenance, for they are made of heavy-duty materials and high-grade vitreous enamel only.

Learn how Wheeler Reflectors and skilled lighting can bring you efficient lighting and cut your costs. Send for catalogs showing complete line of incandescent and fluorescent lighting fixtures. **Wheeler Reflector Company, 275 Congress Street, Boston 10, Mass.** Also New York, and principal cities.

Distributed Exclusively Through Electrical Wholesalers



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Mounts from chain or conduit, individually or in continuous runs.

RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Wheeler Reflectors

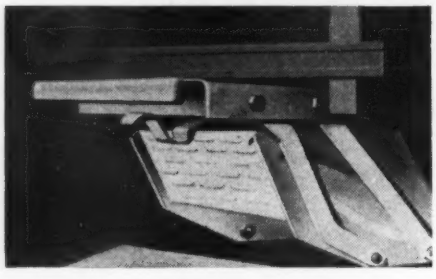
(SKILLED LIGHTING)

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881

NEW EQUIPMENT

Truck-Mounted Folded Steps Ease Lineman's Labors

FOLDING STEPS for mounting on trucks or trailers, to promote safety and to facilitate entering or leaving the conveyance is being announced by Safety Step Co., 1017 South La Brea Ave., Los Angeles 35, Calif. Two



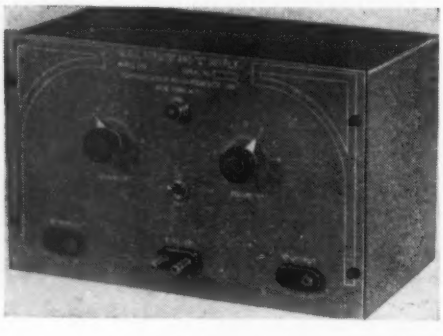
types are available, Model R-16 (illustrated) for mounting at the rear of the platform, and Model S-16 for tight-spot mounting.

No body alterations are necessary to mount the 1,000-lb. capacity, all metal steps, the manufacturer states. The 16-in. steps manually lock in the open position and, when raised, automatically lock in the closed position as shown in the illustration.

•

Dual Power Supplies Available in Single Unit

Two independent, regulated power sources are combined in the CML 1115 Dual Power Supply, Communication Measurements Laboratory, 120 Greenwich St., New York, N. Y., developers of the equipment announced. The "B" supply furnishes a continuously variable



d.c. voltage from 180 to 300 volts, at 70 ma., with a maximum ripple of less than 25 mv. The negative side of the supply is isolated from the chassis, so that the +B may be grounded if it is desired to use the supply as a source of grid bias for tubes which draw heavy grid current.

A continuously variable d.c. voltage from 0 to 75 volts with less than 7-mv. ripple is furnished by the "C" supply.

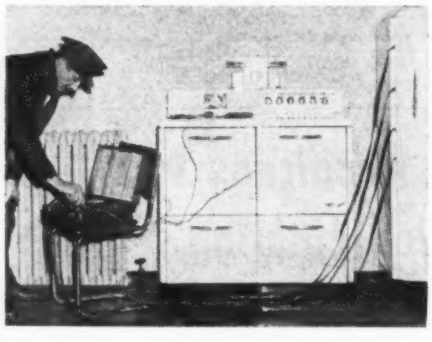
Panel controls are provided to adjust the output voltages throughout the ranges indicated. Independent insulated panel connectors are provided for the high-voltage terminals. Panel binding posts are supplied for connection to a 6.3-volt, 2-amp., unregulated a.c. filament supply. An a.c. power switch and pilot light are also mounted on the front panel as indicated.

•

Tester Gives Refrigerator, Range Temp. Simultaneously

TESTER for checking operating temperatures of refrigerating equipment and electric range ovens simultaneously has been developed by J-B-T Instruments, Inc., New Haven 8, Conn. Four cold zones in the refrigerator and two heat zones in the oven are registered on the meter.

It measures temperatures from —100 deg. F. to +80 deg. F. as a resistance thermome-



ter and from 0 deg. F. to 600 deg. F. as a thermocouple milli-voltmeter with bridge compensation for ambient temperatures. It can also be utilized in measuring line potentials up to 300 volts a.c.

•

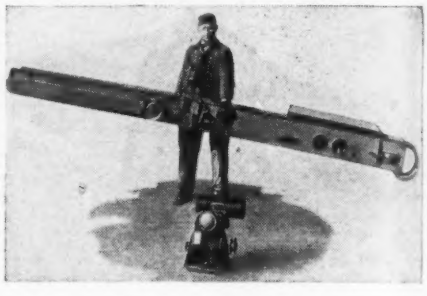
Xenon-Filled Thyratron Developed for Controls

A NEW Xenon-gas-filled, grid-controlled thyratron rectifier tube, Type C16J, was recently developed by Electrons, Inc., 127 Sussex Ave., Newark 4, N. J. It is applicable to welding controls, power rectifiers, and electronic motor speed controls.

Characteristic ratings reported by the manufacturer are filament voltage, 2.5; filament current, 31 amp.; peak forward volts, 1,000; steady direct current, 12 amp.; peak direct current, 100; negative grid control; low grid current; and temperature free.

12-Ft. Portable Coal Conveyor Weighs 135 Lb.

A NEW lightweight portable conveyor, called Tote-All Zephyr, has been announced by Material Movement Industries, 310 South Michigan Ave., Chicago 4, Ill. The unit



was designed primarily to cut down weight of the handling equipment. The 12-ft. model weighs 135 lb.

The unit is made of a corrosion and abrasion resistant alloy steel and is available in 16-ft. as well as the 12-ft. model. Both utilize an 8-in. belt. Power may be supplied by electric or gasoline motor.

•

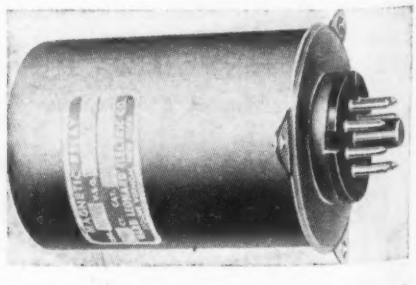
Push Button Switch For Flush Mounting

NEW push button switch (No. 7716) for flush mounting in being announced by Ark-Les Switch Corp., 51 Water St., Watertown 72, Mass. It is of the single-pole, momentary-contact type and is reported approved for 1-amp., 125-volt service. It can be supplied in "normally on" or "normally off" designs.

•

Sealed Plug-In Relays Usable on H. F. Circuits

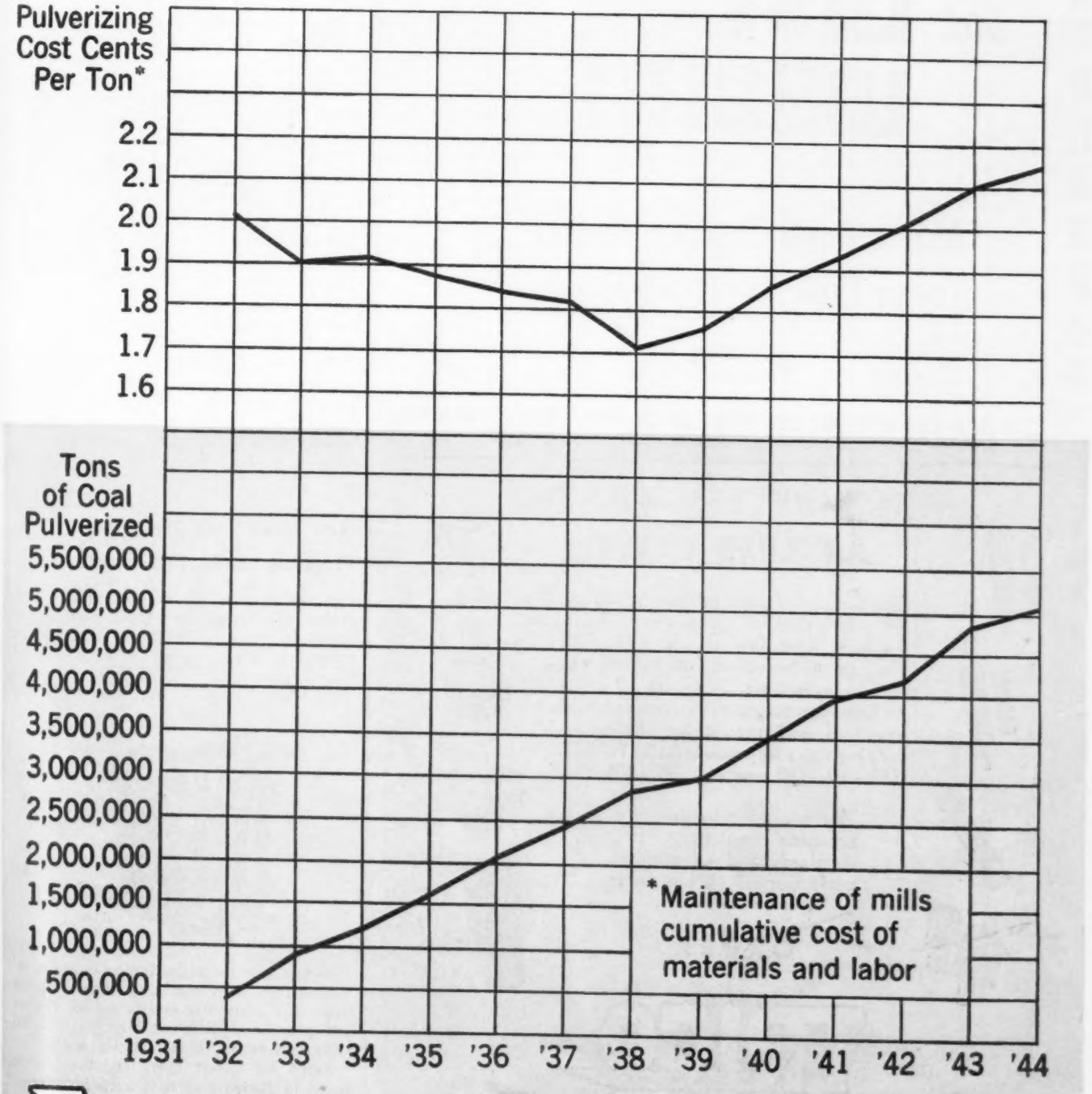
HERMETICALLY sealed plug-in relays for use in h.f. circuits where space is a factor have



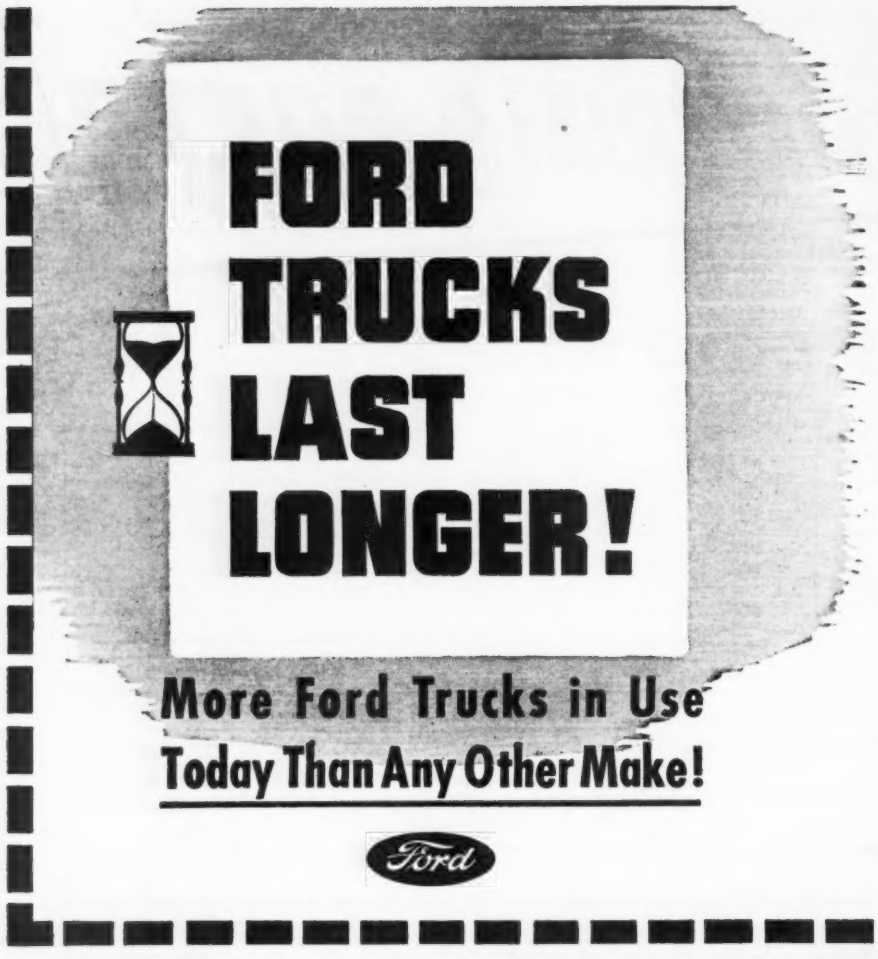
been developed by Ward Leonard Electric Co., Mount Vernon, N. Y. It is available in d.p.d.t. with a.c. contact ratings (at com-

REFLECT LABOR & MATERIALS COSTS

NOT A FACTOR



FOSTER WHEELER



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AT LESS COST
The unequalled performance of TRICO "Powder-Packed" Renewable Fuses, Kantark "One-time" Fuses, Kliplok Clamps for fuse clips, Fuse Pullers, and visible, automatic Oilers for all types of bearings, is proved in thousands of standard and special applications — helping users to produce MORE—BETTER—FASTER and at LESS COST!
There's no substitute for precision manufacturing standards and guaranteed performance! Make sure you get both . . .
ORDER
TRICO
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"PREFERRED FOR QUALITY"
TRICO FUSE MFG. CO.
MILWAUKEE 12, WISCONSIN

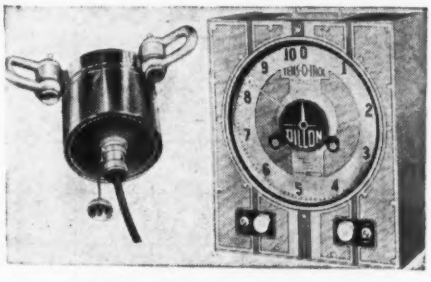
circuit is reported to provide automatic operation and to maintain voltage within ±2 percent from no load to full load with normal engine speed regulation.

The generator is of the revolving-field type, and is built in 5- and 7½-kw, 60-cycle, single-phase and 7½- and 10-kw. 60-cycle, three-phase ratings for 1,200-rpm. operation. It is also available in 7½- and 10-kw, 60-cycle, single-phase and 10- and 15-kw., 60-cycle, three-phase ratings for 1,800-rpm. operation.

•

Sagging Problem Simplified By New Dynamometer

A NEW INSTRUMENT, called Tens-O-Trol, which gives the tension or weight reading



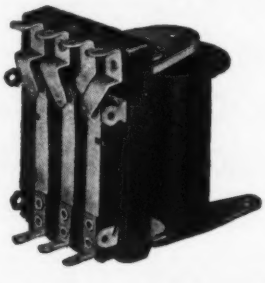
up to 300 ft. from the dynamometer, has been announced by W. C. Dillion & Co., Inc., 5410 West Harrison St., Chicago 44, Ill.

Deflection or reading on the indicator is obtained by electrical connection with the master transmitter dynamometer through the self-synchronous motors. Instruments to indicate up to 20,000 lb. are available.

•

New Series of Relays Stresses Chatter Reduction

A NEW LINE of two- and three-pole relays, Series 16, featuring shock-proof action under stress as high as ten times the force of gravity, is among recent developments of Kurman Electronics Corp., 35-18 37th St., Long Island City 1, N. Y. This relay is de-

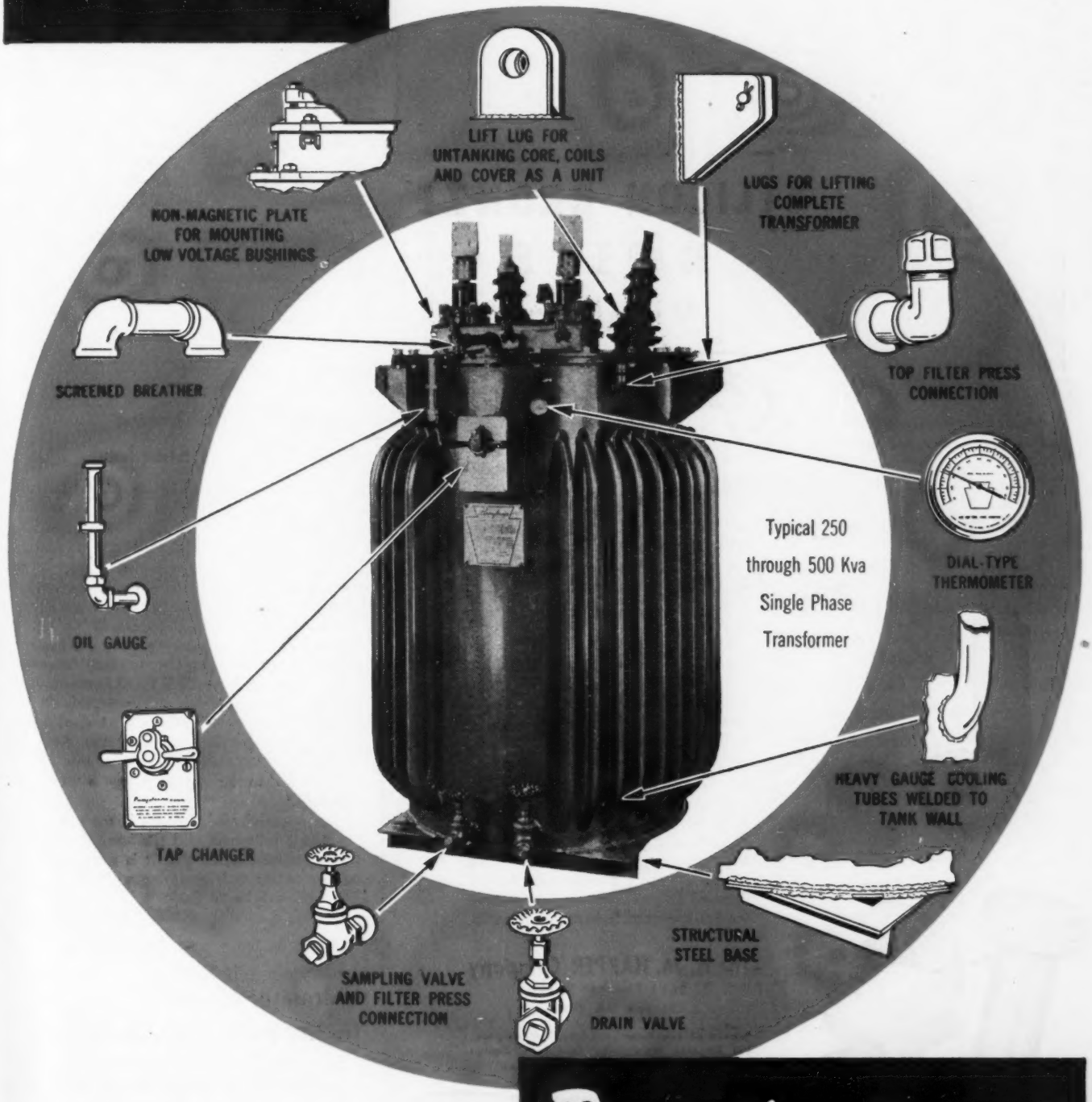


signed so that the activating armature is insulated from the contact arms by a Bakelite link. This feature is said to reduce chatter and provides a dielectric strength of 1,500 volts between all contacts and ground.

Rated for 2-watt operation, the coil is stated to dissipate up to 4 watts in continuous operation without overheating. And any two- or three-pole contact combination is available. The contacts are rated to carry 2 amp. A coil may be selected for any d.c. voltage between 0.5 and 150 volts, any a.c. voltage between 3 and 500 volts. The approxi-

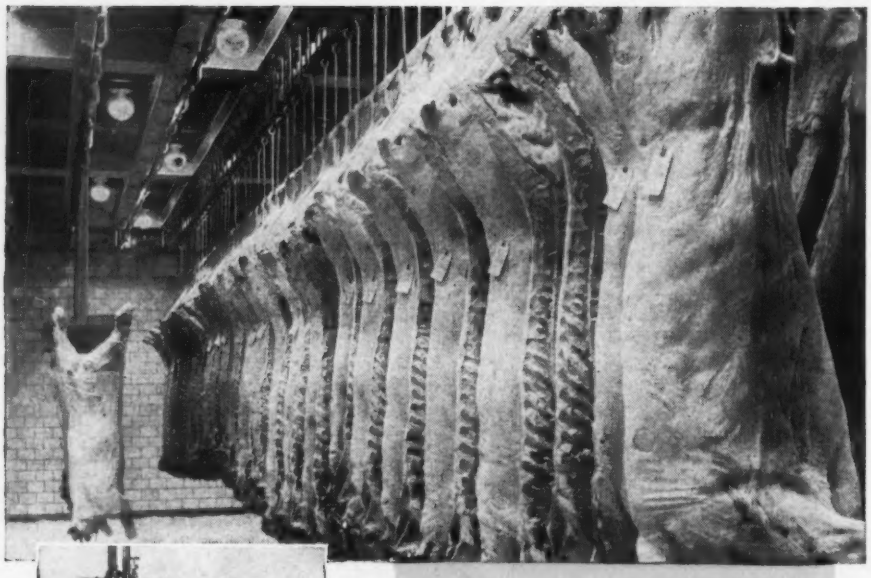
Around a PENNSYLVANIA TRANSFORMER *in 60 seconds*

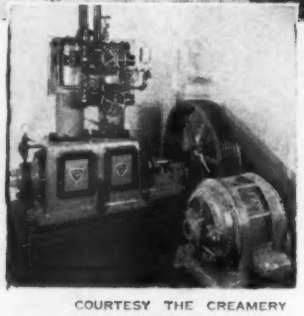
• Yes, we timed it—one minute to read the copy in this ad! We don't presume that you can learn everything about a transformer in 60 seconds. We do maintain, however, that much can be learned from the exterior appearance of a transformer—and in a very short time. The construction of the cooling tubes, the lift lugs, the accessories used, the welding,—all are evident—all invite your inspection. They indicate the high quality Engineering and Manufacturing technique that we are proud to point out in every Pennsylvania Transformer.


LIFT LUG FOR UNTANKING CORE, COILS AND COVER AS A UNIT
LUGS FOR LIFTING COMPLETE TRANSFORMER
NON-MAGNETIC PLATE FOR MOUNTING LOW VOLTAGE BUSHINGS
SCREENED BREATHER
TOP FILTER PRESS CONNECTION
Typical 250 through 500 Kva Single Phase Transformer
DIAL-TYPE THERMOMETER
OIL GAUGE
HEAVY GAUGE COOLING TUBES WELDED TO TANK WALL
TAP CHANGER
STRUCTURAL STEEL BASE
SAMPLING VALVE AND FILTER PRESS CONNECTION
DRAIN VALVE

Pennsylvania
TRANSFORMER COMPANY
808 RIDGE AVENUE, N. S., PITTSBURGH, PA.

Pennsylvania TRANSFORMERS





COURTESY THE CREAMERY PACKAGE MFG. CO., CHICAGO

SILICON BRONZE BOLTS Vital to *Refrigeration*

Metrex Valve Company, Franklin Park, Illinois, specifies Harper Bronze Bolts for their dehydrators and strainers which dry refrigerant and remove sludge to assure efficient and uninterrupted freezer operation.

Thousands of carloads of perishable foods for home consumption—and for our good neighbor shipments abroad—require constant refrigeration to prevent spoilage and waste. The brunt of this refrigeration is borne by the sturdy freeze units made up of many components working in acid and moisture laden environment highly corrosive to common steel. Metrex dehydrators and strainers, and many other such parts depend upon the high tensile strength and acid and corrosion resistant properties of Silicon Bronze Bolts which can be easily removed for servicing and reused indefinitely.

A wide variety of fastenings made from Brass, Naval Bronze, Silicon Bronze, Monel and Stainless are available for prompt shipment from large Harper Stocks. Harper's Special Engineering facilities serve the Refrigeration Industry constantly.

The H. M. HARPER Company
2611 Fletcher Street
Chicago 18, Illinois

Branch offices: New York City, Philadelphia, Los Angeles, Milwaukee, Cincinnati, Dallas
Representatives in principal cities

HARPER *Chicago*

mate dimensions are 2 in. long x $1\frac{5}{8}$ in. wide x $1\frac{3}{4}$ in. high. It weighs 4 ounces.

•

Flash Tube Has Output Of 12 Million Lumens

A NEW gas-discharge flash tube providing instantaneous high intensity light for obstruction markers, beacons, airport boundary markers, and other similar signaling applications has been announced by the Sylvania Electric Products Inc., 500 Fifth Ave., New York 18, N. Y.

The tube may be operated in a relatively simple condenser discharge circuit to provide flashes of 1/5,000-second duration with a peak light output of 12 million lumens. Daylight quality light with color temperature ranging between 6,000 and 7,000 K is produced in a xenon-discharge coil. Equipment may be designed to operate wholly from portable battery power or directly from 120 volt a.c. line.

Typical R4330 flash tube is mounted in a T-11 bulb; measures $5\frac{15}{32}$ in. over medium ceramic octal base; is $1\frac{13}{32}$ in. in diameter and has an average rated life above 10,000 flashes, the manufacturer reports.

•

Frequency Calibrator Uses WWV as Standard

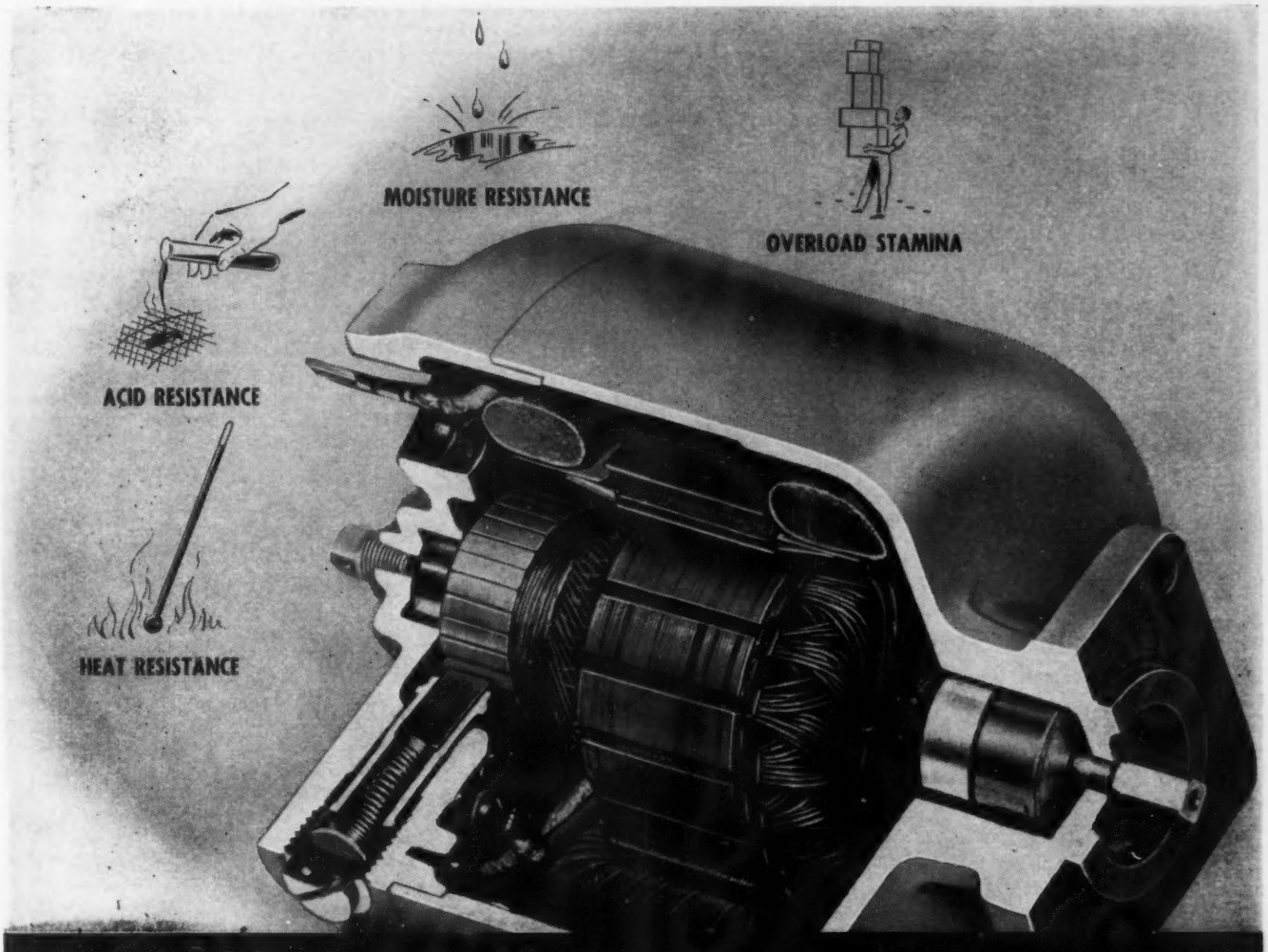
A NEW frequency calibrator, Model RH-10, which allows full use to be made of the standards transmitted from radio station WWV, is being announced by Browning Laboratories, Inc., Winchester, Mass. It is pretuned for 5 and 10 megacycles; either may be selected at will. Provisions are made for coupling secondary standards or other RF sources and comparing their fundamentals or harmonics with the standard frequencies transmitted by WWV. A cathode-ray indicator permits frequency comparisons to be made to at least 1/10 cycle. A dual filter allows the selection of either the 440- or 4,000-cycle modulation. This allows these frequencies to be employed as a primary standard.

The sensitivity of the unit is reported better than $\frac{1}{2}$ microvolt and the image rejection ratio is more than 50 db. It is supplied in a cabinet or box rack mounting with dust cover. The unit weighs 30 lb.

•

Voltmeter Usable In 20-Cps. to 700-Mc. Range

MODEL 410A high-frequency vacuum tube voltmeter is a multi-purpose instrument for laboratory, broadcast station, and production-line use and is introduced by Hewlett Packard Co., Palo Alto, Calif. It measures a.c. voltage from 20 cps. to 700 mc., d.c. voltage at 100 megohms input impedance, and resistance from 0.2 ohms to 500 megohms. For making a.c. measurements, a special low-capacity probe is employed which



How much is "*High-Safety-Factor*" insulation worth to you?

It's worth plenty, if efficient, dependable operation of electrical equipment is important to your business—if moisture, oil, heat, overload, corrosive acids and vapors and human carelessness or inexperience represent hazards that can throw expensive machinery out of service or cause costly delays.

Fortunately, the cost of added protection against the penalties frequently imposed by these conditions is slight—far less than the penalty imposed by failures that can be avoided. For the advantages of High-Safety-Factor Insulation can be added at only a small fraction of the cost of the equipment.

That's why the swing is to Fiberglas Electrical Insulation Materials —why so many engineers, production executives and maintenance men are insisting on Fiberglas Insulation for the equipment they buy and for their maintenance work.

Get complete information about this better electrical insulation material—write for your copy of the folder "Are your motors a good insurance risk?" The names of the Distributors serving your locality will also be furnished, if you desire. Owens-Corning Fiberglas Corporation, Department 858, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario

OWENS-CORNING

FIBERGLAS

T.M. REG. U.S. PAT. OFF.

Fiberglas is the trade name for these electrical insulation materials and many other products made from fine, strong, pliable, moisture and heat-resistant, ageless glass fibers.

Where and How to Use *Crapo* Steel Conductor

Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

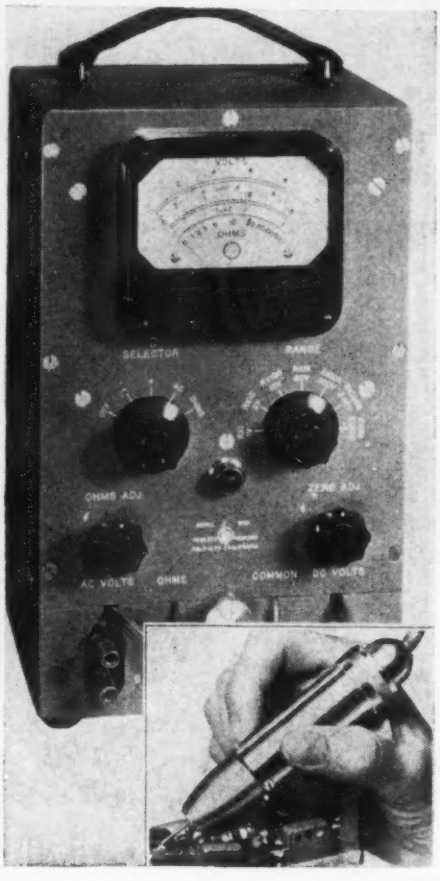
Crapo Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.

Indiana Steel & Wire Company
Muncie, Indiana

Crapo
Steel Conductors

incorporates a new diode especially developed by Eimac for this instrument. Input capacity is 1.3 mmfd.; input resistance is 6 megohms below 10 mc., and is less at higher frequencies due to dielectric losses. On a.c., up to 300 volts may be read in six ranges. D.c. measurements may be made to 1,000 volts in seven ranges; input impedance for d.c. measurements is 100 megohms for all ranges. For making a.c. measurements in low impedance circuits, the probe may be stored in a compartment in the instrument and connections made to binding posts on the front panel. Overloads will not damage the instrument, the manufacturer reports.



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Diode Plate Current Controlled by Magnetic Field

A NEW magnetically controlled diode tube, Type 2B23, has been announced by the tube division, General Electric Co., Syracuse, N. Y. Designed to make magnetic control relatively simple in industrial applications, the new tube is said to offer many advantages over conventional grid-control tubes in d.c. amplifier applications. Low-voltage, high-current control circuits can be used with the tube as easily as high-voltage, low-current circuits by proper choice of the control solenoid, according to the manufacturer's announcement.

A high-vacuum diode in which the plate current can be controlled by a magnetic field, it has a d.c. plate voltage of 150 volts and a plate current operating range of 30 milliamperes when used as a direct-current amplifier or electronic switch.

Coaxial Cable Connector Provides Water-Tight Joint

A NEW CONNECTOR used in making a water-tight connection on coaxial cable is now being introduced by Barker & Williamson, 235 Fairfield Ave., Upper Darby, Pa. It was designed primarily to be used in the antenna circuit but may also serve as the center insulator for a half wave doublet the manufacturer states.

The connector, "CC-50," is made of aluminum with steatite insulation and has two forged steel eyebolts that are equipped with soldering connections. A bottle of weather-proof cement and a piece of $\frac{3}{8}$-in. outside diameter rubber tubing, plus the necessary assembly screws, are supplied with each connector. The assembled unit weighs 12 oz.

•

Magnetic Motor Starter Available in Larger Sizes

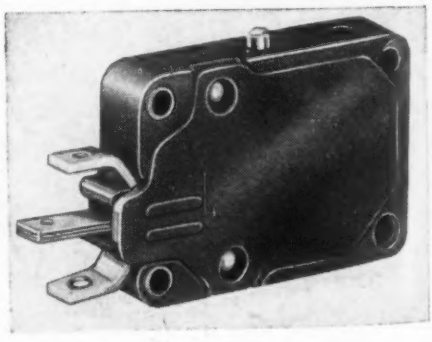
NEW SIZE 3 magnetic motor starter is a recent addition to the line made by Federal Electric Products Co., Hartford, Conn. It is similar in design to the smaller sizes—00, 0, 1 and 2,—but since it interrupts heavier currents, heavier parts are utilized and minor construction changes have been made.

It is available for motor sizes up to 50 hp. operating at 440-600 volts. Among the features reported are double-break silver contacts, individual arc chambers and movable contacts mounted on individual mold blocks and stated to be easily removable for inspection and replacement. All wire connection terminals are of solderless pressure type.

•

Switch Case Strengthened By Recessing Cover

A NEW Model "M" rolling spring snap-action electric switch with improved structural features is announced by Acro Electric Co., 1340 Superior Ave., Cleveland 14, Ohio. Its new molded case is designed for greater strength by means of a fully recessed cover which is inserted clear of the four $\frac{5}{32}$-in. diameter mounting holes. Size of barriers between the terminals has been increased. To make wiring easier, heavier solder terminals are used with 0.082-in.



terminal holes. This new model switch is made for single-pole, single- or double-throw contacts and is rated at 10 amp., 125 volts.

NEWS ABOUT PEOPLE

Sacramento Municipal Makes New Appointments

Sacramento (Calif.) Municipal Utility District, which will acquire the electrical distribution system of the Pacific Gas & Electric Co. on December 31. has made several new engineering appointments.

Paul E. Shaad has been appointed chief design engineer and will be responsible for the design of the electric distribution system to be acquired, serving approximately 63,000 consumers in a 650-sq. mi. area. Mr. Shaad was formerly employed by the Hawaiian Electric Co. as electrical planning engineer.

Harold W. Warmoth has been appointed general superintendent of the district. Mr. Warmoth, who has been associated with Pacific Gas & Electric for the past 23 years, is a graduate in electrical engineering of the University of California. For the past eight years he has handled all affairs in connection with condemnation proceedings on the electrical properties that the district will control. His duties will include direction of all phases of the operation, construction and maintenance of the system.

P. E. Shaad

H. C. Purcell and Charles R. Day have been named assistant designing engineers for the district. A graduate of Stanford University, Mr. Purcell was formerly connected with the Hawaiian Electric Co., Honolulu, T. H. He is a member of the American Institute of Electrical Engineers. A graduate of the University of California, Mr. Day for the past seven years served as assistant electrical engineer for Modesto (Calif.) Irrigation District. He is also a member of the American Institute of Electrical Engineers.

H. W. Warmoth

•

H. R. Waldo Made President of Telluride Power Co.

H. R. Waldo has been elected president of the Telluride Power Co., Richfield, Utah, to succeed H. B. Waters, who has been made chairman of the board of directors.

Mr. Waters has been president since 1940. Mr. Waldo has been serving as secretary. Both make their headquarters in Salt Lake City, although the company serves southern Utah.

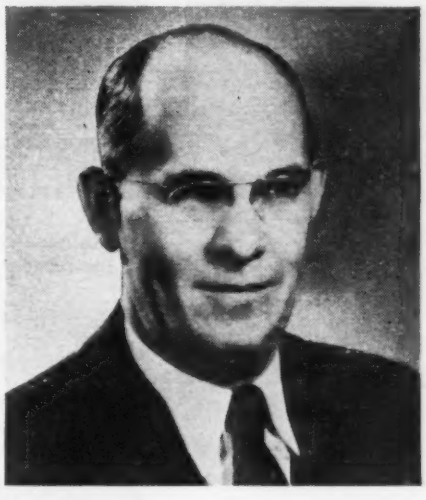
H. R. Waldo

Both Mr. Waters and Mr. Waldo joined Telluride in 1911. Mr. Waters served first as engineer in charge of construction of a plant on the Malad River, Idaho, while Mr. Waldo was employed first in the Provo office. When the Malad River plant was sold to Idaho Power Co. in 1916, Mr. Waters moved to Richfield to direct development of properties in southern Utah. Mr. Waldo is succeeded as secretary by W. L. Biersach, Richfield, who also is treasurer.

•

R. P. Wagner Heads E.E.I. Commercial Committee

Ralph P. Wagner, commercial manager of the New York Power & Light Corp., Albany, N. Y., has been elected chairman of the commercial division general committee of the Edison Electric Institute. In his new position, Mr. Wagner will supervise the activities of 22 commercial committees of the electric utility trade association, which are now engaged in load-building activities in all phases of utility promotional work.



R. P. Wagner

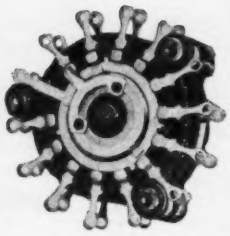
Mr. Wagner has long been known in the utility industry. He took a major part in preparing the sales training course sponsored by the Institute for appliance salesmen, and his past experience will assist greatly in coordinating the development of national promotional programs for use by utilities in all sections of the country. He succeeds G. W. Ousler, vice-president of Duquesne Light Co., who has just completed a two-year

YOU CAN NOW GET THESE DAILY ESSENTIALS

• • •

INSTRUMENT & TESTER SWITCHES

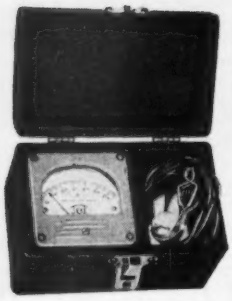
12-14 and 20 position. Shorting; non-shorting 1-6 decks.



(SS-14-2)

OPERATING TEMPERATURE TESTERS

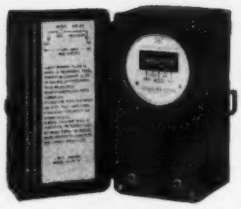
Automatically compensated, typical range for ovens, 0-650°F.



(32-JPI)

400 CYCLE PORTABLES

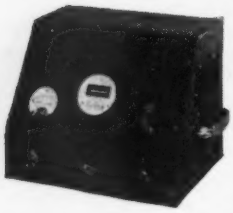
Accuracy to ±0.3%; pocket size metal case; other ranges.



(33-FP9-400 cy.)

VACUUM-TUBE FREQUENCY METERS

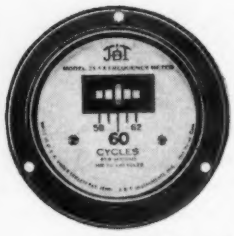
Accuracy, ±0.25%; six specific bands, to 3600 cps. No drift.



(39-VTF)

MOST COMPACT FREQUENCY METERS

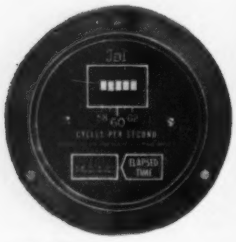
Matches standard 2½" panel instruments. 60, 120 cps.



(21-FX-60 cy.)

ELAPSED TIME—FREQUENCY METERS

3¼" mounting; encourages periodic servicing and tube-life checking.



(31-FE)

MULTIPLE RANGE PORTABLES

Standard—4 frequency groups at 3 voltages. Many special order variations.

(60-FP)

POTENTIOMETER-PYROMETERS

Measures and follows temperatures continuously after initial balancing.

(70-PO)

...many of these, and others from the J-B-T line, are now stocked by leading jobbers.

J-B-T INSTRUMENTS, INC.

439 CHAPEL STREET • NEW HAVEN 8, CONNECTICUT

for E. E. I. term as commercial division chairman.

Prior to his association with New York Power & Light, Mr. Wagner was identified with the Durham (N. C.) Public Service Co. and with the Cities Service Co., at St. Joseph, Mo., in the capacity of results engineer for the electric generating plants of that company west of the Mississippi. He was assigned to the New York office of Cities Service in 1926, and three years later joined New York Power & Light staff.

Mr. Wagner is a past member of E.E.I.'s rate research and general sales committees.

•

▶ EDWARD LUXEMBERG, for more than 20 years mechanical superintendent at the Cahokia power plant of the Union Electric Co., St. Louis, has been appointed assistant to the chief engineer of the company. Mr. Luxemberg started with Union Electric in 1911.

▶ WILLIAM V. WOODWARD, formerly power sales supervisor of Northern Indiana Public Service Co., Hammond, Ind., has become associated as sales and application engineer with the organization of N. M. Mintz, who is the sales engineering representative in the Chicago territory for a number of electrical manufacturers.

▶ E. F. PEARSON has been appointed assistant general manager of the Northwestern Electric Co., Portland, Ore. With offices in Vancouver, Wash., Mr. Pearson will manage the company's Washington division. A veteran of 34 years' service with Northwestern, Mr. Pearson formerly was assistant to the general manager. His experience was largely in the engineering field until he entered administrative work 11 years ago.

▶ L. J. L'HEUREUX has recently been appointed to the newly created position of superintendent of the Fort Pierce (Fla.) electric utilities. Mr. L'Heureux was associated with the Alabama Power Co. for 16 years in various capacities, including the position of district superintendent, then joined The Okonite Co. in New Jersey and since May 1942, until April of this year was in military service, Army Engineer Corps.

▶ LEWIS H. BROWN, president of Johns-Manville Corp., has been awarded the highest civilian decoration, the Medal for Merit, for "outstanding services on problems of management, production and supply." From June 1942, until the end of the war, Mr. Brown served as an unpaid industrial advisor to Lt. Gen. L. H. Campbell, Jr., then Chief of Ordnance, U. S. Army Service Forces. In addition, Mr. Brown, at the request of the government, directed the construction and op-

BETTER MILKING METHODS are demonstrated by Leader Robert Westlake to members of the Valley Center 4-H Livestock Club.

"ELECTRIC MIXING is definitely a Better Method" says Mrs. Eugene Westlake to a group of 4-H girls in her Gallatin home.

GALLATIN COUNTY Extension Agent George A. Woolley discusses the Better Methods Electric Program with W. H. Reif of Montana Power, Jake Tiedema of Bozeman Chamber of Commerce, and John Ravet, President of Gallatin County 4-H Leaders' Council.

How you, too, can participate...

You can do as scores of progressive utilities are doing—simply tie-in your rural activities with the Better Methods Electric Contest, which is now in full swing in your territory. There is nothing for you to *develop* or *originate* to identify your organization with this worthwhile 4-H Program. *Everything is ready and waiting for you!*

FREE...*everything you need for promoting your own Better Methods Electric Program*

We give you every help to make your Program an outstanding success: *Guide Books* which explain every phase of Better Methods ... *Report Folders* in which 4-H'ers can develop and report their projects ... *Leaflets* for wide-spread distribution to 4-H Club members ... *Farm Bulletins* on the many uses of electricity on the farm ... *Posters* for display in your show windows ... *Ideas* to help you conduct your locally-sponsored Better Methods Electric Program.

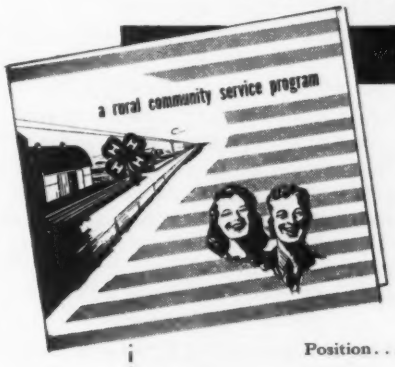
Now's the time to get started for 1947!

Begin, *now*, to plan your Better Methods Electric Program for 1947—so you will be ready to go *early next year*. Send for the portfolio: "A Rural Community Service Program." In it you will find samples of the free material described above, and other helpful information. *Contact your nearest Westinghouse office—or mail coupon.*

Tune in: TED MALONE—Monday, Wednesday, Friday, 11:45 am, EDT, American Network.

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE



MAIL COUPON TODAY!

Rural Electrification Section (EW-72046)
Public Relations Department
Westinghouse Electric Corporation
Box 1017, Pittsburgh 30, Pennsylvania

Please send *free copy* of
"A Rural Community Service Program."

Name.....

Position.....

Company.....

Address.....

City.....Zone.....State.....

Keep their minds on their work-

BUCKINGHAM EASY BELT No. 58: Floating feature. No metal contacts body. Made of finest harness leather and lined with soft chrome lace leather.

BUCKINGHAM STANDARD SAFETY STRAP NO. 42A: Drop-forged, tested snaps and buckles, reinforced with metal to increase strength and wear. Made from backs of best selected harness leather.

BUCKINGHAM SPUR PROTECTORS: Keep spurs sharp and give climbers longer life.

with BUCKINGHAM *Safety* Equipment

STEPHENS CLIMBERS: Originator and sole manufacturer of this famous climber, Buckingham rigorously maintains the quality and safety standards that have made them famous for 45 years.

Physical discomfort and fatigue . . . nervous strain and constant hazard . . . all tend to distract the lineman and lower his efficiency. Buckingham safety equipment helps to keep his mind on his work. It has won his confidence by 45 years of reliable performance. It's proved scientific design reduces discomfort and saves his energy. That's why it is a favorite with the U. S. Army Signal Corps, with 28 great utility companies, and with many telephone companies, railroads and fire departments all over the United States.

Write for Catalogue 24 showing the complete Buckingham line.

Buckingham distributors in many principal cities

Buckingham MANUFACTURING CO., INC.

Walter E. Craw, President 5-7 Travis Street, Binghamton, N. Y.

eration of the Kansas Ordnance Plant, which produced $550,000,000 worth of urgently needed ammunition for the fighting fronts.

▶ E. Donald Gray-Donald, chief engineer, Quebec Power Co. and Quebec Railway, Light & Power Co., Montreal, Que., has been elected president of the Canadian Transit Association. All the years of his professional career have been spent in the Province of Quebec. In 1926 he became identified with the Shawinigan Water & Power Co. and one year later was transferred to Quebec Power Co. Mr. Gray-Donald is a member of the Engineering Institute of Canada.

▶ W. G. Dorsett, director of industrial relations of the Sangamo Electric Co., Springfield, has been named a member of a committee "to promote a better understanding between management and labor" by the Illinois State Chamber of Commerce.

▶ Joseph E. Workman, at present Chicago, Ill., district manager for the Latrobe Elecrtic Steel Co., Latrobe, Pa., has been appointed assistant sales manager for the company, effective August 1. Mr. Workman was employed by the Logan Gear Co., Toledo, before going with Latrobe, and served in the latter's Toledo branch prior to being made manager of the Chicago branch.

▶ Merrold S. Johnson has been named manager, advertising and sales promotion division, Edison General Electric Appliance Co., Chicago. He was formerly with Arnold Schwinn Co., Chicago manufacturers of bicycles.

▶ F. M. Mitchell, manager, special market sales division, Frigidaire Division, General Motors Corp., has been assigned the position of manager, laundry equipment sales. Mr. Mitchell was formerly director, consumers' durable goods division, War Production Board, Washington, N. C.

▶ John Bess, president of Refrigeration Corp. of America, a subsidiary of Noma Electric Corp., has been elected a vice-president of the parent company.

▶ Robert K. Spofford, formerly assistant purchasing agent of The Okonite Co., Passaic, N. J., has been appointed purchasing agent to succeed the late George S. Hayes. Mr. Spofford, who will also be in charge of purchasing for The Okonite-Callender Cable Co., Inc., Paterson, N. J., has been an active buyer for ten years, first with the Continental Can Co. where he served as purchasing agent for the plants in the New York metro-

DISSOLVED OR ENTRAINED AIR

in circulating water—one of many factors governing condenser tube and heat exchanger tube performance—is presented in this discussion by Scovill engineers on selection of the proper tube alloy.

Fast-flowing rivers, rapidly changing tides, spray ponds and moving ships all create a condition causing entrainment of air. Furthermore, all raw water is saturated with dissolved air. Approximately 2.7 cu. ft. of air will dissolve in 1000 gal. of water — the quantity of air to saturate being dependent on the water pressure, composition and temperature. Any low-pressure areas in the circulating system permit the liberation of part of this dissolved air to ally itself with any free air in its erosive-corrosive attack on the tubes.

In actual operating conditions, where dissolved or entrained air in the circulating water is only one of the variables, tube life depends on the nature and/or extent of such other factors as: Velocity and turbulence of coolant . . . Chemical composition of circulating water . . . Temperatures inside and outside of tubes . . . Chemical or electro-chemical actions . . . Marine growths or other deposits . . . Sewage and wastes present . . . Development of protective film . . . Media surrounding tubes.

One of the principal objects of Condenser Tube Technical Research has been the development of alloys designed to give the user longest tube life and most trouble-free service. Where the major factor affecting tube life is the presence of dissolved or entrained air, satisfactory alloys include Cupro-Nickel, Aluminum Brass and Phosphorized Admiralty, each within its temperature limitations.

So many variables surround any condenser or heat exchanger tube application that each case must be treated as an individual problem.

Data accumulated during Scovill's continuous study of condenser and heat exchanger tube service conditions for every known application equip its Technical Service Department to offer sound guidance in tube alloy selection for existing or proposed installations.

THREE SCOVILL SERVICES

Scovill's *Service in Men* offers experienced engineering to help solve your tube selection and installation problems. *Service in Metals* develops and produces Scovill tube alloys that conform to your requirements. *Service in Manuals* consists of literature which gives you latest, authentic information on condenser and heat exchanger tubes. For a free copy of Condenser Tube Booklet, address Scovill Manufacturing Co., 24 Mill St., Waterbury 91, Conn. *Export Dept.* 405 Lexington Ave., New York 17, N. Y.

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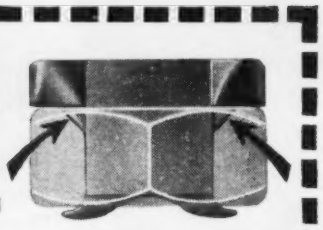

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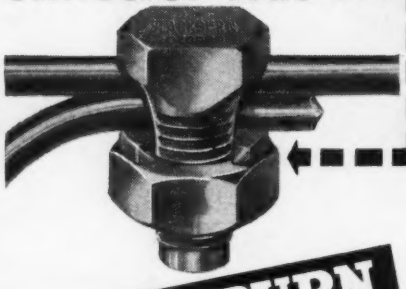

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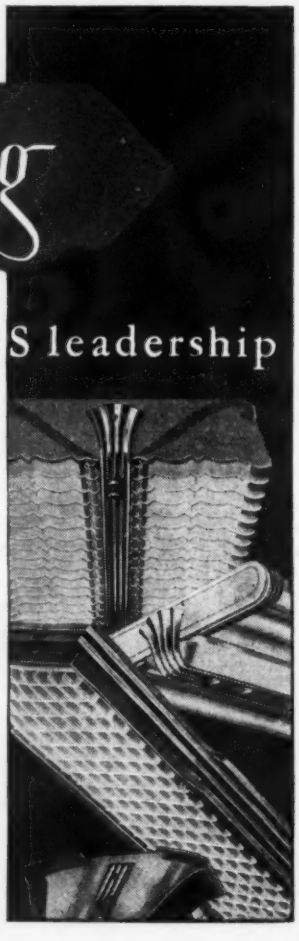

Smithcraft LIGHTING DIVISION Chelsea 50, Mass.

politan district and later, during the war, when he became assistant chief purchasing agent of the Concan Ordnance Co., at Terre Haute, Ind. Mr. Spofford has been associated with The Okonite Co. since 1943.

OBITUARY

George C. Mathews

George C. Mathews, vice-president of the Standard Gas & Electric Co., Chicago, and former member of the Securities and Exchange Commission and Federal Trade Commission, died on July 11 at Highland Park Hospital, Chicago, following a cerebral hemorrhage. He was 60 years old.

Mr. Mathews became a vice-president of the Standard Gas & Electric Co. in 1943, to assist with the company's administrative activities during the absence of Leo T. Crowley, who had been appointed head of the Office of Economic Warfare. Mr. Mathews entered the Standard Gas System in 1940, when he joined the Northern States Power Co., but when that company ceased to be a subsidiary of Standard Gas in 1942 he left Northern States to become vice-president of the Public Utility Engineering & Service Corp., subsidiary service organization of the Standard Gas system.

A native of Northwood, Iowa, and a graduate of the University of Wisconsin, Mr. Mathews over a period of years was employed by the Public Service Commission of Wisconsin and its predecessor, in charge of public utility rates and accounts and during part of the period in charge of the administration of the Wisconsin blue sky laws for the strict regulation of security sales.

In 1933 Mr. Mathews was appointed vice-president of the Middle West Utilities Co., from which position he went to Washington as a member of the Federal Trade Commission, which was then charged with the administration of the Securities Act. On the formation of SEC in 1934 he was appointed a member of the board, retaining this position until 1940, when he joined Northern States Power Company.

•

► CHARLES E. PARRY, chief engineer for the Pennsylvania Public Utility Commission, died on June 6 at Harrisburg, Pa. He was 68 years of age.

► H. NEWTON WALKER, executive vice-president of Walker Brothers, manufacturers of electrical equipment, Conshohocken, Pa., died at his home in Short Hills, N. J., on July 8 at the age of 64. A native of Newton, Kan., Mr. Walker became associated at an early age with

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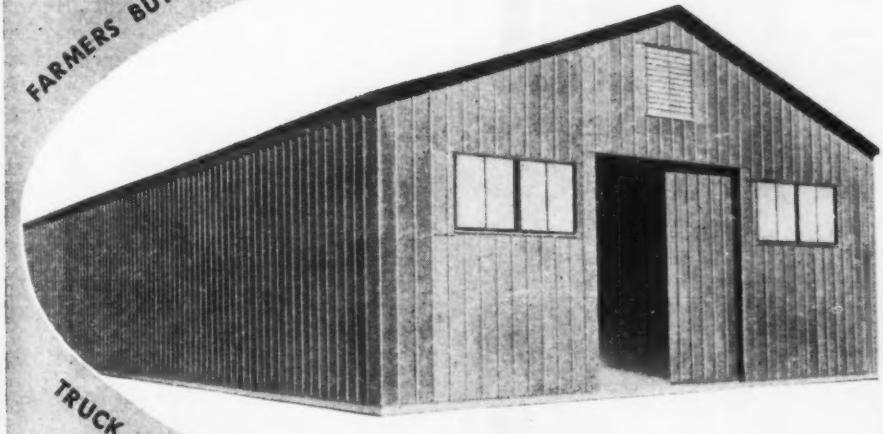

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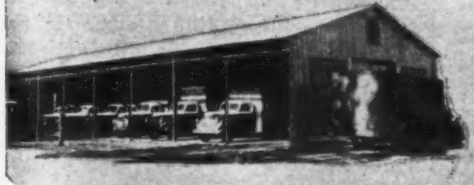
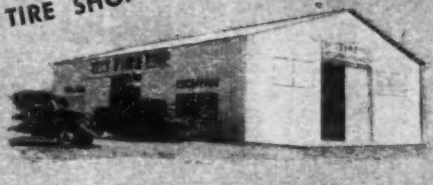


POTATO WAREHOUSE

TIRE SHOP



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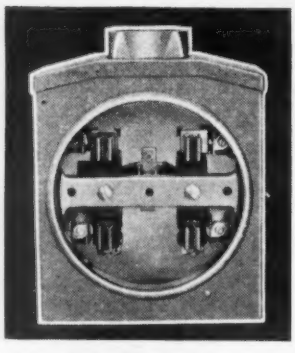
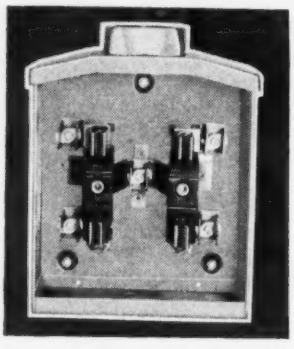


← CAT. 8800 Front View

CAT. 8800 Front View → Cover Removed



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the Walker Electric Co., founded by his father. In 1912 Mr. Walker became one of the founders of Walker Brothers, Conshohocken, and as executive vice-president had charge of their interests in New York City.

▶ BROWNE R. CHESTNEY, vice-president of Georgia Power Co., and manager of the Macon division for many years, died at his home in Macon July 5 after a long illness. Mr. Chestney, 61 years old, was graduated from Georgia Tech in 1906 with an engineering degree and joined the Macon Railway & Light Co. and the Central Georgia Power Co., predecessors to the Georgia Power Co.

▶ HAROLD P. DANIELS of Clinton, N. Y., retired electrical engineer, formerly secretary and a director of Peet & Powers, Inc., of New York, died in Utica, N. Y., on July 1 as the result of injuries suffered in an automobile accident. He was 65 years of age. Born in New York, Mr. Daniels was graduated from the engineering school of Columbia University in 1902, and after three years with the General Electric Co. in Schenectady, joined Peet & Powers. In the first World War, Mr. Daniels supervised electrical work in the United States Bag Loading Plant at Seven Oaks, Va., and during the recent war, that at the Quonset Point Naval Base, Rhode Island.

▶ ALBERT D. DONOVAN, assistant secretary of the American Gas & Electric Co., New York, died suddenly in that city on June 21. He was 57 years old. Born in Pittsburgh, Mr. Donovan was graduated from the University of Pittsburgh. After a period on the staff of the Pennsylvania Public Utilities Commission at Harrisburgh, Pa., Mr. Donovan joined the American Gas & Electric Co. in New York in 1923. In a few years he became assistant secretary.

▶ EUGENE P. SUMMERSON, formerly secretary of Electric Bond & Share Co., New York, died at his home in Great Neck, L. I., on July 1. He was 68 years of age. Mr. Summerson had been connected with utility companies since 1903, when he became assistant to the manager of the Decatur (Ala.) Light, Power & Fuel Co., Decatur. Four years later he became general auditor of Carolina Power & Light Co., and in 1909 joined Electric Bond & Share as general auditor. He was elected assistant secretary of the company in 1916, and nine years later secretary. On the formation of Ebasco Services, Inc., in 1935 he was named secretary of that organization. Mr. Summerson was a director of Electric Bond & Share until 1940, when he retired from the board for reasons of health.

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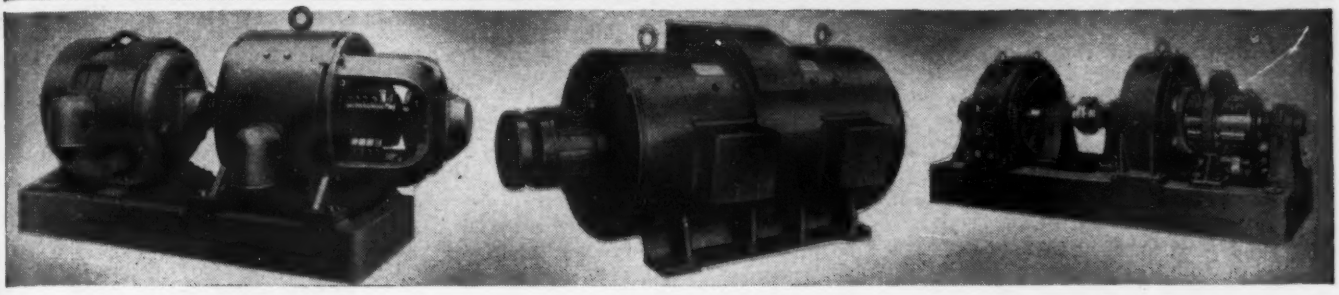

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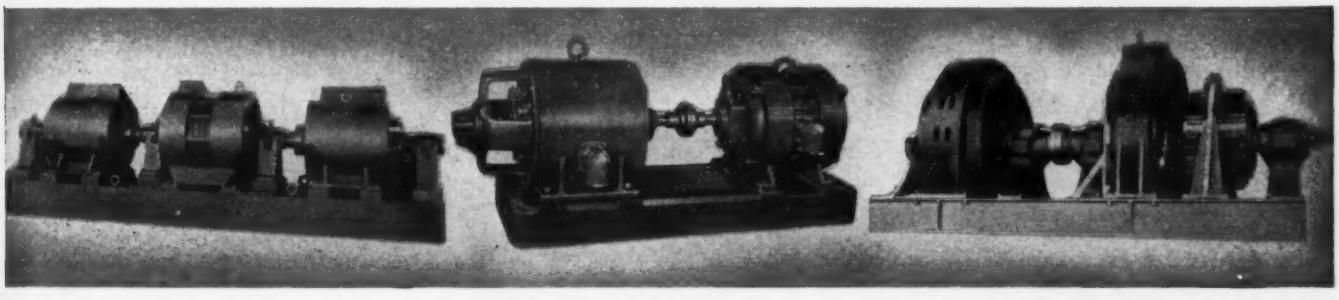
◆ 5 k.w. Exciter M-G Set
◆ 1000 k.w. Synchronous Motor Driven



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ABOVE are illustrated a few typical Burke M-G Sets. These will remind you that Burke is able to meet your most exacting specifications up to capacities of 1000 KW. Burke, one of the oldest and largest independent builders of synchronous equipment and a pioneer in the manufacture of DC equipment, has the experience to design and build the correct M-G set for your power needs. State K W and voltage desired on generator and voltage, phase and cycle for motor drive — describe the application to be made.

For a description of the complete Burke line of AC and DC motors and generators, consult Sweet's Engineering catalogs or Electrical Buyers Reference catalog.

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Illumination Laboratory Dedicated By Benjamin

To contribute to the advancement of the science and art of illumination, a new product development and testing laboratory has recently been completed and dedicated by the Benjamin Electric Mfg. Co., Des Plaines, Ill. Hoyt P. Steele, company vice-president, made the dedicatory address outlining the aims, purposes and plans for the new unit and at the same time presented L. J. Vavrinek, chief engineer, with the dedication plaque.

The dedication exercises, which coincided with the company's 45th anniversary, were attended by technical editors, industry and civic leaders. G. K. Hardacre, manager of commercial sales, Public Service Co. of Northern Illinois, responded briefly to Mr. Steele's talk.

Housed within the new building are five laboratory divisions—an electrical section, a physical test section, a photometric laboratory, an acoustical laboratory, and a product development and model shop.

The heart of the electrical section's circulatory system is the control and distribution board. It provides an electronically controlled variable frequency alternator which produces test frequencies from 12 to 70 cycles at a range of 12 to 250 volts. The board also provides controls for a remotely mounted d.c. motor-generator set to produce the following voltage ranges—5 to 30, 30 to 150, 150 to 280 volts d.c. On the board is also mounted a variable autotransformer for obtaining potentials of from 1 to 270 volts, at 60 cycles, and regulators for controlling this voltage within narrow ranges. The third part of this board is a plug-in type distribution panel from which it is possible to distribute the various ranges of a.c. and d.c. to the test benches.

The photometric laboratory provides an easy and efficient means of testing all types of fixtures at various heights up to 22 ft. The physical test section contains a weather-ometer, a humidity chamber, a temperature control chamber, a salt spray machine, and a vibration tester. It also has a weathering tower on the roof which is used to test floodlights and other outdoor lighting equipment under the actual conditions which are simulated in the laboratory.

In the model shop, hand models are made for preliminary illumination and electrical characteristics and performance tests. The acoustical laboratory, with its non-resonant sound absorbing walls, and ceiling and lead lined doors, provides the necessary facilities for measuring sound frequencies and analyzing sounds.

DEDICATED TO ADVANCEMENT—At the dedicatory exercises of the new Benjamin laboratory, Hoyt P. Steele, company vice-president, presented L. J. Vavrinek, chief engineer, with a plaque stating "Dedicated To The Advancement of The Science & Art of Illumination." The right photograph shows the photometric laboratory in use. It is 70 ft. long, 20 ft. wide, and 22 ft. high. The floor is inlaid with zinc strips in 12-in. squares to facilitate locating test points for measurements

G.E. Second Quarter Showing Due to Apparatus Orders

Orders received by General Electric Co. during the first six months of this year amounted to $389,696,000 compared with $695,496,900 in the same period of 1945, a decrease of 44 percent, President Charles E. Wilson announced last week.

Orders received in the first quarter of 1946 totaled $111,775,000 which is 72 percent less than the $395,466,000 booked during a similar period in 1945. The second quarter figures show a remarkable improvement: 1946, $277,921,000 against $300,030,000 for 1945. This is a decrease of only 7 percent.

"The improvement in the second quarter as compared with the first quarter of this year was due principally to increased business in apparatus lines," Mr. Wilson stated. "Also, since all the company's principal plants were closed by a strike, and no shipments made for nine of the first thirteen weeks this year, first quarter orders did not include that portion of the business in appliances, lamps, etc., which otherwise would have been reported in accordance with our long established practice of recording such items in orders received only as they are shipped to customers."

•

Production On Increase In Westinghouse Plants

Heavy equipment and appliance output is making rapid strides toward overcoming strike-enforced production delays in the Westinghouse plants, Gwilym A. Price, company president, informed the board of directors this week. East Pittsburgh production of generators, large motors and circuit breakers has attained 90 percent of the pre-strike planned production rate.

Output of transformers at the Sharon plant is currently running at 75 percent above the 1939 level and fractional horsepower motors are coming off the line at Lima at a rate 18 percent above the 1941 average.

Refrigerators are being completed at approximately 1,000 per day and this, Mr. Price states is about 50 percent of the normal pre-war output. Production of irons and roasters is ahead of pre-war records and is currently 3,000 units

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MARINE AND POWER EDITION

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Condenser and Heat Exchanger Tubes

Most Common Factors Influencing Corrosion Rate

Numerous laboratory examinations of condenser tubes which in some instances have given many years of service and in others only a few weeks or months of service, have revealed that there are probably at least a dozen different factors which influence the rate of corrosion of condenser or heat exchanger tubes in power plants. These factors may function in an adverse manner or they may be beneficial as listed in the table below. The problem is complicated by the interaction of these factors. This should not necessarily discourage us from trying to uncover the most troublesome factor or combination of factors. In many instances individual consideration of all of these corrosion rate factors has helped to uncover the most troublesome one.

In previous issues of the Copper Alloy Bulletin, we discussed the effects of alloy composition and water composition, as well as the acceleration of corrosion due to the deposit of foreign matter. We also mentioned a few of the preventive measures to increase tube life such as cleaning of tubes and removal of a large percentage of entrained gases from the circulating water before it enters the tubes.

Steam and Steam Condensates

All of the copper base alloys usually have excellent corrosion resistance to steam and steam condensates of low impurity content. Occasionally stress corrosion cracking or corrosion grooving localized near tube sheets and supports is encountered where the condensate contains much ammonia. Corrosion grooving sometimes occurs when much carbon dioxide is present. Thinning of tubes has also occurred when much hydrogen sulfide was present.

High Water Velocity May Lead to Impingement-Corrosion

In condenser and heat exchanger tubes the movement or turbulence of some waters at the inlet ends of tubes frequently leads to localized corrosion—commonly called "impingement-corrosion" or "inlet-end-corrosion". The seriousness of this type of attack varies with the alloy composition, water composition, water velocity and the quantity and size of entrained gas bubbles and sand. When much entrained gas is present in the water stream, the impingement corrosion pits are undercut on the down stream side at those points where the gas bubbles (second phase) impinge on the metal surface. Aluminum Brass, 70/30 Cupro Nickel containing about ½% iron and Duronze IV (arsenical aluminum bronze) have the best corrosion resistance to this type of attack in sea water. "Inlet-end-corrosion" is also combated through the use of various protective measures applied to the inlet ends of tubes, such as Flowrites, plastic inserts, and coatings.

Effects of High Velocity Steam

Steam containing droplets of water (second phase) traveling at high velocities and impinging on condenser and heat exchanger tubes will rapidly corrode most metals. This is usually encountered in those tubes facing the steam inlet and steam lanes. The surface is roughened by numerous cones all tilted in one direction. Sometimes the tips of the cones do not develop and the corroded surface may be covered with a large number of minute cones with rounded tops. Trouble from this source is kept to a minimum by (1) removing as much moisture as possible from the steam, (2) use of the most corrosion resistant metals, (3) maintaining high quality steam and (4) the use of steam deflector plates.

Effect of Internal and External Stresses

The effect of applied (static) or residual (resulting from cold drawing) stresses upon the copper base alloys varies considerably depending upon the composition of the alloy and the corrosive environment (moist ammonia). Certain copper alloys under these conditions may fail from localized corrosion (stress corrosion or season cracking) in the form of narrow cracks which gradually penetrate the tube wall. This type of corrosion is best combated by keeping stresses and the concentration of ammonia at a minimum; where these cannot be controlled then the use of copper, 70/30 cupro nickel, or Duplex tubing should be considered. Residual stresses resulting from cold work during the manufacture of tubes are eliminated by the stress relief obtained by annealing to meet the grain size requirements of A.S.T.M., Federal, Navy, and other specifications. Duplex Tubes, however, are normally supplied in the hard condition.

Cyclic stresses associated with vibration may lead to fatigue or corrosion fatigue cracking of condenser and heat exchanger tubes. These failures can be recognized from their location, that is, a few up to several hundred minute circumferential cracks develop midway between tube support sheets or within a few inches from the tube sheets. In addition such tube failures generally occur at those points where the steam or vapors enter the condenser or heat exchanger, that is, in tubes facing the inlet or vapor lanes (top to bottom of lane). Stopping the vibration is the most satisfactory way to combat this situation. This has been done through the use of tube stiffeners and additional tube support plates.

Alloy Selection

As we learn more about the complex subject of corrosion, we begin to appreciate the very important role played by the metals and alloys from which condenser and heat exchanger tubes are made. Engineers who take the trouble to study experimental lots of different alloys tested under actual service conditions are of course in an excellent position to know, when the time for retubing comes around, which alloy will serve best. Such results lead to the purchase of tubes on a service basis rather than on a first cost basis. Further information on condenser and heat exchanger tubes can be obtained from our Technical Service Dept. Write for your copy of Bridgeport's Condenser Tube Manual—112 pages full of technical data and useful tables.

Most Common Factors Influencing the Rate of Corrosion

The letter or letters in parentheses following each factor indicates whether or not this factor generally has an adverse ("a") or beneficial ("b") effect on the corrosion rate as the value of concentration increases.

1. Alloy Composition ("a" or "b")
2. Composition of Water
   - (a) Anions, specific nature and concentration ("a" or "b")
   - (b) Cations, specific nature and concentration ("a" or "b")
   - (c) Total dissolved solids ("a" or "b")
   - (d) pH and pHs ("a" or "b")
   - (e) Gases, H_2S, Cl_2, CO_2, O_2, NH_3 (usually "a" occasionally "b") rate of supply, concentration, distribution.
   - (f) Organic Material, specific nature and concentration ("a" or "b")
   - (g) Total suspended matter, nature, size, etc. ("a" or "b")
   - (h) Conductivity ("a")
3. Composition of Steam and Steam Condensate Similar to items 2a to 2h
4. Nature and Distribution of
   - (a) Corrosion products ("a" or "b")
   - (b) Silt and debris ("a" or "b")
5. Velocity of
   - (a) Water with ("a") and without a second phase (solid or gas)
   - (b) Steam with ("a") and without a second phase (liquid)
6. Stress
   - (a) Static ("a")
   - (b) Residual ("a")
   - (c) Cyclic ("a")
7. Design of Heat Exchanger ("a" or "b")
8. Operation of Heat Exchanger
   - (a) Continuity of operations (affects factors 5, 6, 8, 9 and 11) ("a" or "b")
   - (b) Method of cleaning (affects factor No. 4) ("a" or "b")
9. Temperature on Outside and Inside
   - (a) Low ("a" or "b")
   - (b) High ("a" or "b")
10. Pressure on Outside and Inside
    - (a) High ("a")
    - (b) Low ("b")
11. Galvanic Coupling ("b")
12. Physical Properties ("a" or "b")
    - (a) Hardness, (b) microstructure
    - (c) Fatigue Characteristics

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FORD TRUCKS LAST LONGER!

More Ford Trucks in Use Today Than Any Other Make!

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per day, according to the announcement.

Electric ranges which were partially assembled before the strike are being taken from storage, equipped with heating units, and shipped to distributors. Production of the heating units was held up because of the inability of obtaining a new special hydraulic press.

He also stated that the company has received $191,817,000 worth of new orders in the first five months of 1946 and this brought the backlog of unfilled orders to $421,979,000. Good progress is now being made in converting this backlog into sales billed, Mr. Price stated.

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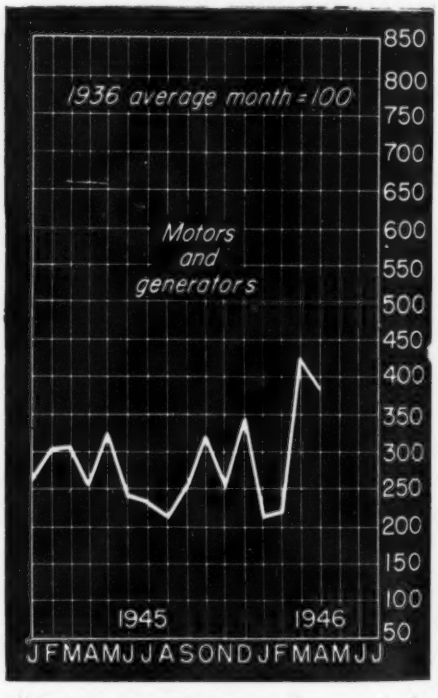
New Generator Orders Decrease 10% in April

Orders received for motors and generators during the month of April dropped 10 percent in comparison with



NEMA index, value of orders received

March orders, according to figures released by the National Electrical Manufacturers Association. The index compiled by NEMA moved downward to 385 in April from 429 in March. In April, 1945, the index stood at 258, this year's figure representing an increase of 49 percent.

The 1945 monthly indexes include an adjustment for cancellations reported up to December 31. No adjustment has been made for renegotiation of contracts.

•

$2,000,000 Air Unit Contract

Installation of air-conditioning plants in a state-wide chain of 400 Florida movie theatres, under a $2,000,000 contract, has been announced by Carrier Corp.

ILSCO ELECTRICAL CONNECTORS

100% CONDUCTIVITY

Due to the 99% pure electrolytic copper drawn right in our plant from seamless copper tubes . . . EVEN WITH OVERLOAD YOU'LL GET 100% SATISFACTION.

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Steel HANGERS, CLIPS, STRAPS

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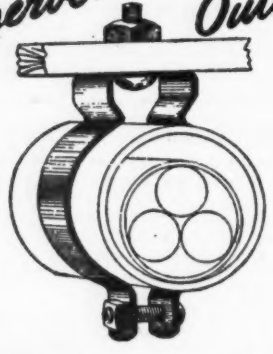

Minerallac Cable, Conduit and Messenger Hangers are STEEL. Easier, quicker to install; permit speedy, compact wiring; economical. Also in Everdur . . . Porcelain Insulating Bushings available.

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Jiffy STEEL Clips (Pipe-clamp) require only one screw, nail or bolt; rib-strengthened; for hanging pipe, conduit, BX cable, mounting coils, etc. Millions in use.

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Steel Straps for Messenger-cable services on outlet boxes; may be used in conjunction with hangers.

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SPECIFICATION that calls for excellent performance

TEST that is thorough-going, reliable and, preferably, independent

CERTIFICATION (if desired) to evidence test-proven compliance with specification

SPECIFICATION
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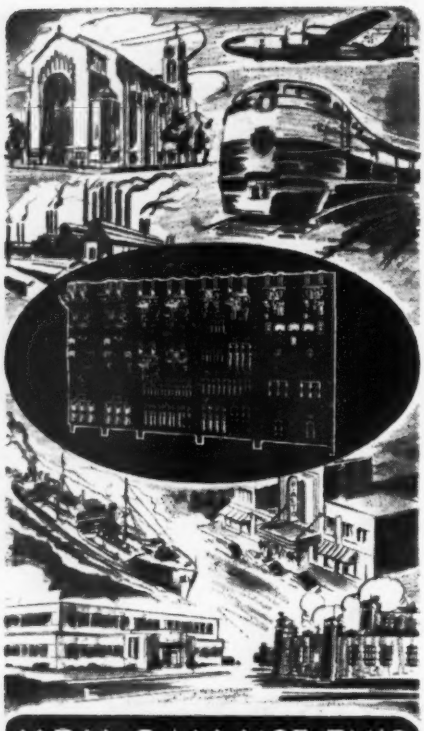

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FIELD REPORTS ON BUSINESS

Diversified construction in electric utility systems is proceeding despite handicaps in material supply. Commercial cooking equipment sales are active and there is much street lighting modernization. Materials are still short in wire and cable field.

CHICAGO

REA provided close to $10,000,000 for construction in Illinois during the twelve months ended June 30, 1946, covering the construction of 5,817 miles of lines serving 18,125 customers. Borrowings in Wisconsin were much higher than in Illinois for the 1946 fiscal year, totaling almost $16,000,000, but providing 290 fewer miles of lines serving 21,839 consumers.

Independent Pneumatic Tool Co. plans a far-reaching program designed to open the comparatively untapped market for electric power tools on farms, which it describes as a "million-dollar field." Some 3,000 dealerships will soon be established in country hardware and electric equipment stores and implement dealers for the sale of a line of electric drills and bench grinders. Present backlog of orders for these items will keep the plant at top production speed well into 1947. Farm electrification is a major factor opening the new market. This trend will enable farmers to do their own repairs on the premises.

Holub Industries has begun manufacturing electrical and mechanical products at Sycamore, Ill., including industrial electrical blowers, vacuum cleaners, circuit and voltage testers and wire connectors and strippers. Borg-Warner has introduced ten new models of household appliances at the Furniture Mart show now in progress. These include a home freezer, five new refrigerators and a new electric range. Conlon Corp. has signed a long-term contract with Western Auto Supply for large quantities of household washers and ironers.

NEW ENGLAND

Diversified construction in electric utility systems is proceeding despite handicaps in material supply. Improvements under way on the New England Power System group include a counterpoise on the Bellows Falls-Pratts Junction, 110-kv. transmission line; facilities at Tewksbury substation in Massachusetts, a major transmission center; a new 110-kv. structure at Franklin Square substation, Providence, R. I., with the addition of a 40,000-kva. transformer; new substation facilities at Gloucester, Mass., on connection with the installation of a second 23-kv. now under way between that city and Beverly, Mass.; replacement of five oil circuit breakers by air circuit breakers at Haverhill; rehabilitation of pipe line at Searsburg (Vt.) hydro plant; new substation for East Pepperell, Mass.; and construction of a 33-kv. single circuit line between Elmwood substation in Providence and Drum Rock, 10.75 miles, including 4.75 miles of G.E. gas-filled cable and the balance overhead work of the "Polarm" type.

Commercial cooking equipment sales are active, with notable installations recently completed or on order on the Hartford Electric Light system. These include outstanding drug stores, philanthropic and religious institutions, highway restaurants and various lunch places. Some 60 new electric kitchens have been planned as a result of this company's display at a recent home builders show. Elsewhere in this territory electric ranges and refrigerators are slowly coming into distributors' hands for delivery on back orders. Socket appliances are being produced in better volume. Raw materials are still short in the wire and cable field.

Employment and production are approaching pre-war volume on vacuum cleaners, fans and compressor units for refrigeration at the East Springfield Works of Westinghouse Electric Corp.

NEW YORK

Business due to new building and alterations were the high points in business news this week. A total of 43 new factory buildings plans were filed and these will be constructed at a cost of $1,500,000. Alterations of factory plants planned total 85 and are expected to cost $2,500,000. New mercantile buildings for New York total 90 and are expected to cost $1,230,000.

Contracts for the large housing developments are going out. One of the largest in the electrical field is for the 244 elevators for Metropolitan Life Insurance Co.'s Stuyvesant Town. This single contract approached the $3,000,000 mark. Also awarded was the contract for 24 elevators to be installed in Metropolitan's Riverton development in Harlem.

Refrigerators and washing machines are not being received in greater numbers because of the fractional horsepower motor shortage. Production expected to be at much higher rate this fall. Ironers are expected in volume at approximately the same time. Radios are arriving in larger numbers but these are mainly the small portable sets with plastic cases.

Some concern is being expressed in the trade over the decreased rate of savings in 1946 as compared to 1945. The savings now are at about one-third the rate of the last quarter.

PACIFIC COAST

The fall and holiday merchandising season will be formally opened by the Los Angeles Market Week beginning July 29, followed in San Francisco a week later. Great interest and a record attendance is indicated by advance reservations on the eve of production approaching pre-war levels.

Stock shortages of practically all staple items are hampering electrical construction and maintenance, and increased volume of factory shipments for wholesalers' stocks are lagging behind ever-increasing backlogs of orders, because manufacturers have not yet overcome the dislocation of production due to recent strikes.

Baldwin's bid of $2,083,800 was low for five 62,200-hp. turbines for Davis Dam, Allis-Chalmers being low with $155,000 for the governors. Other heavy machinery for which bids are due in early August includes a 20,000-kva. condenser for Davis and three 40,000-kva. transformers for Columbia Basin besides such heavy line construction as the 69-kv. sector from Davis to Kingman, Ariz. and the 145-kv. Rio Grande tap to Alamogordo, N. M.

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to build increased consumption...ECONOMICALLY

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WITH THIS IN MIND, our Public Utility Systems specialists have developed sales control plans that provide the information required in a constantly-up-to-date history of all company-customer sales relations. Through ingenious use of Kardex, with its visible margins and signal features, this type of record becomes a self-analyzing, graphic "picture" of conditions necessary for accurate, day-to-day control.

THE SALES MANAGER can see in a glance
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SALESMEN ARE TOO VALUABLE for clerical work. With *visible* records directing their activities, their productive sales time is increased to the maximum.

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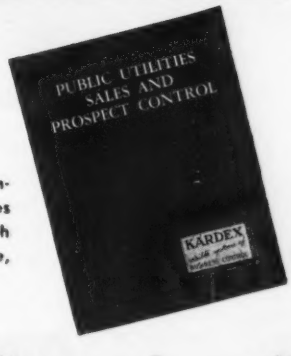

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SALES OPPORTUNITIES

MISSOURI—Empire District Electric Co., Joplin, plans new 154,000-volt transmission line from generating station at Riverton, Kan., to Aurora, where new power substation is proposed for connection with transmission lines in northern Arkansas. Project will be part of an expansion program now being arranged for extensions and improvements in generating stations, power substations, transmission and distribution lines in different parts of territory served in Missouri, Kansas and Arkansas. A fund of about $5,000,000 will be arranged for entire program.

CALIFORNIA—Haas, Baruch & Co., 421 East Second St., Los Angeles, food products, plans new plant at 4700 Boyle Ave., Vernon district, with main one and part three-story building, about 58,000 sq. ft. floor space, for processing and general production. Machinery and electrical equipment will be installed for large capacity. Also will build warehouse and other structures. Entire project estimated to cost about $1,000,000. Albert C. Martin & Associates, 333 South Beaudry Ave., Los Angeles, are architects. Work on superstructure will begin soon.

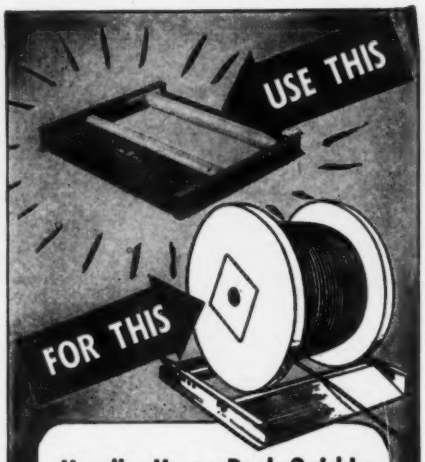
CALIFORNIA—Purchasing Department, Los Angeles Water and Power Bureau, 311 South Spring St., Los Angeles, will receive bids until August 12 for six 6,667-kva. 34,500/5018 volts distribution station-type transformers, with alternate bids for six similar capacity shell-type distribution station transformers (Specifications 9434).

PENNSYLVANIA—Dill & Collins Division, Mead Corp., Richmond and Tioga Streets, Philadelphia, coated book and other coated papers, plans large expansion at mill, including several new one and multi-story buildings, with machinery and electrical equipment for heavy increase in present output. Cost reported over $4,500,000. George F. Hardy, 411 Lexington Ave., New York, N. Y., is consulting engineer.

INDIANA—Town Council, Monroe, will receive bids until August 15 for three 100-kva. 6,900/2,400-volt oil-cooled, outdoor-type transformers; and for two 24-kva. feeder regulators, for municipal electrical distribution system.

WISCONSIN—Wisconsin Public Service Corp., Green Bay, will begin work soon on new transmission line from Valders to New Holstein, about 20 miles. Immediate construction also authorized on new transmission line from Ingalls to White Rapids, Mich., approximately 13 miles.

ARIZONA—Bureau of Reclamation, Denver, Colo., will receive bids until August 9 for one 20,000-kva., 13,800-volt, 3-phase, 60-cycle hydrogen-cooled, outdoor-type, synchronous condenser, with separate motor-generator, including motor-driven main and pilot exciters, with exciter power-supply equipment (except transformer), starting auto-transformer, instruments, instrument transformers, protective relays, voltage regulator, rheostats, field switch, and all other switching and control equipment, etc., for Davis dam project, Arizona-Nevada. Equipment will be installed by government (Specifications 1407).



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Perk up your pre-summer profits with Solar's fast-selling insect-repellent lamps. STOCK THEM!—DISPLAY THEM!—THEY SELL FAST with our effective silent salesman display.

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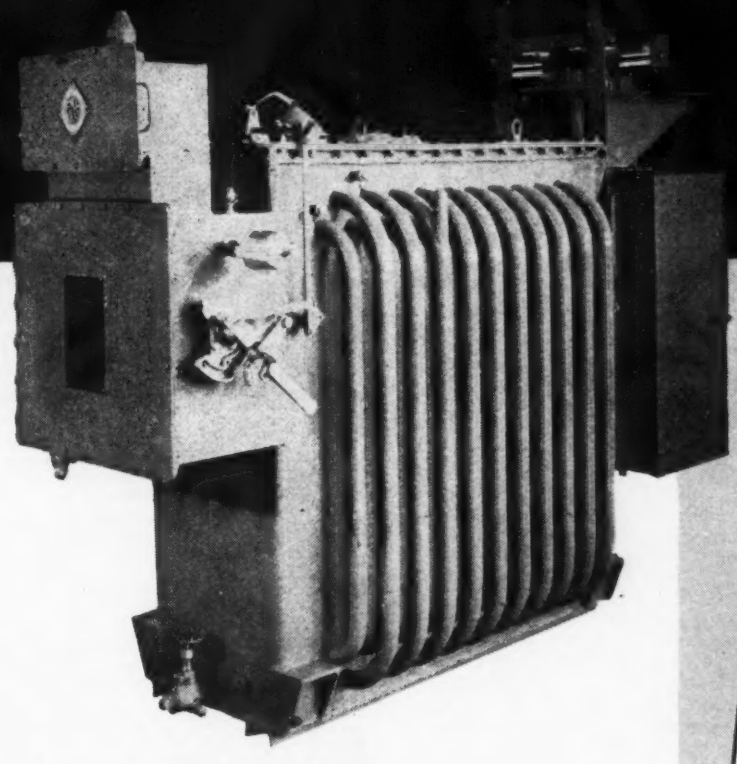
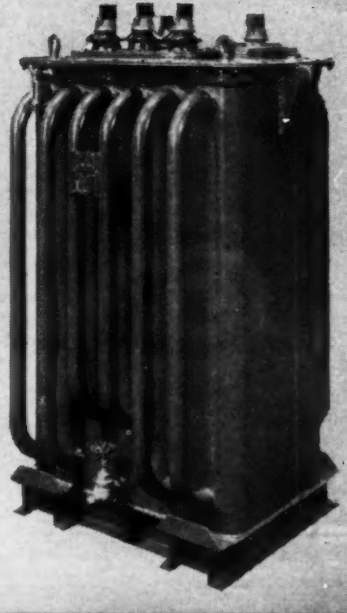
AMERTRAN ABESTOL-IMMERSED TRANSFORMERS

for *safe,* efficient distribution service



AmerTran Abestol Transformers meet the full requirements of the National Electrical Code. They *do not* require fireproof enclosing vaults. Since there are no installation restrictions, they can be installed as close to the center of load as desired.

- **Non-Inflammable**
- **Require no vaults**
- **Save installation space**
- **Reduce copper costs— locate at load center**
- **High efficiency**



ABESTOL, the non-inflammable AmerTran liquid used in these transformers, has high dielectric strength and efficient cooling properties. It does not generate inflammable gases.

Abestol Transformers are particularly suited to locations where the hazard of fire must be avoided. At the same time they afford other distinct advantages. Installation usually is simpler and less expensive than that required for oil-filled types. They can be installed indoors or outdoors, on platforms, directly at the load center. They make possible substantial savings in length and cost of secondary lines.

Abestol Transformers can be supplied for power and distribution service in all practicable ratings and ratios. Write for further information.

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MANUFACTURING SINCE 1901 AT NEWARK, N. J.

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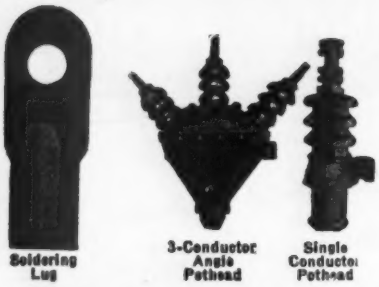

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Reduce accidents and service interruptions

#21 Socket Wrench List Price $1.25

An ideal meterman's tool that will greatly reduce the possibility of damage through short circuits caused by the tool. Walden Worcester Spintite type forged and tempered steel blade, hardened socket COHARDITE insulated to the socket head. Available in 5/16", 3/8", 7/16" and 1/2" hex nut size. Every tool tested to its full rated dielectric strength of 20,000 volts for one minute RMS before it leaves our plant.

A full range of COHARDITE insulated small tools carried in stock for meter and distributor departments.

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The Connecticut Hard Rubber Co.

448 East Street, New Haven, Conn.

TENNESSEE—E. I. duPont deNemours & Co., Nylon Division, duPont Building, Wilmington, Del., plans new mill at Chattanooga, comprising several one and multi-story processing and production buildings, with machinery and electrical equipment. No official estimate of cost announced, but reported in excess of $2,000,000. Work is scheduled to begin soon.

ALABAMA—City Council, Alexander City, plans extensions and improvements in municipal electrical distribution system, including new lines and power substation facilities. Entire project estimated to cost about $150,000. Proposed to arrange financing through federal aid.

KANSAS—City Council, Beloit, plans extensions and improvements in municipal power plant, with installation of equipment for increased capacity. Also will carry out expansion in municipal waterworks station and system. Estimates of cost are being made. Financing will be arranged in part through federal aid. Wilson & Co., 223 North Santa Fe St., Salina, are consulting engineers.

NEW MEXICO—Bureau of Reclamation, Denver, Colo., will receive bids until August 12 for construction of 115-kv. transmission line from Alamogordo to Hollywood. Certain materials will be furnished by government (Specifications 1424).

CALIFORNIA—Pacific Gas & Electric Co., San Francisco, has asked bids for structural steel framing for proposed new steam-electric generating station near Bakersfield, and will place award soon. Erection is scheduled to begin early next fall. Plant will be equipped for rating of 80,000 hp., and is estimated to cost close to $10,000,000, with transmission lines. Stone & Webster Engineering Co., 49 Federal St., Boston, Mass., is engineer.

OHIO—Solvay Process Co., 40 Rector St., New York, N. Y., has purchased Buckeye Ordnance Works of government at South Point (Lawrence County) comprising large group of one and multi-story buildings, used for production of hydrous ammonia and ammonium nitrate during war period. A reported consideration of $13,293,000 was given for property, which will be taken over by purchasing company at early date. It will be used for commercial fertilizer manufacture in future. Buildings will be changed to suit new line of output, with installation of machinery and electrical equipment for large capacity. Cost of latter program estimated at $1,000,000.

MINNESOTA—Rural Cooperative Power Association, Maple Lake, has rejected bids for construction of proposed new power plant and power substation at Hawick, recently received. Proposed to ask new bids in near future. United Engineering Service, Kasota Building, Minneapolis, is consulting engineer.

WASHINGTON—Bureau of Reclamation, Denver, Colo., will receive bids until August 1 for two 100-ton, single-trolley, motor-operated overhead traveling cranes; and for one 60-ton similar-type motor-operated traveling crane; and one lifting beam for Grand Coulee pumping station, Columbia Basin project (Specifications 1417). Also, until August 19 for one 300-kva. indoor unit substation, and one 75-kva. indoor load center, each consisting of high-voltage terminal and disconnect chamber, transformer section, and low-voltage circuit-breaker section; and for one 150-kva. similar indoor unit substation, all for installation at Grand Coulee dam, same project. Equipment in both cases will be installed by government (Specifications 1428).

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Scientifically designed links eliminate unnecessary blow-outs. Solar is the PREFERRED cartridge fuse—everywhere!

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Manufacturing plant employing less than 600 people. Please give full particulars and salary expected.

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MAKE your own

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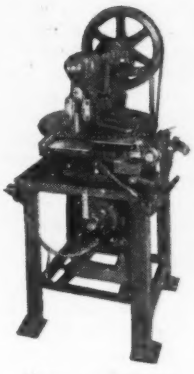

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THERE are a thousand and one uses for these indispensable machines: for marking patterns, systematizing pattern departments and storerooms . . . for gas and electric meters . . . for pole tags . . . for marking wires, cables . . . for following parts through processes of manufacture.

Roovers single- and multiple-line Type Embossing Presses are available with letters from ⅛ to ¾" high . . . any desired wording or length . . . any metal. Hand- and power-operated. Easy to operate. Economical to buy . . . and to use.

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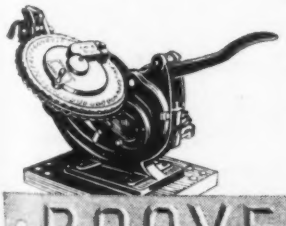

The Hand Label Embosser (above), Hand operated Model BB (left).

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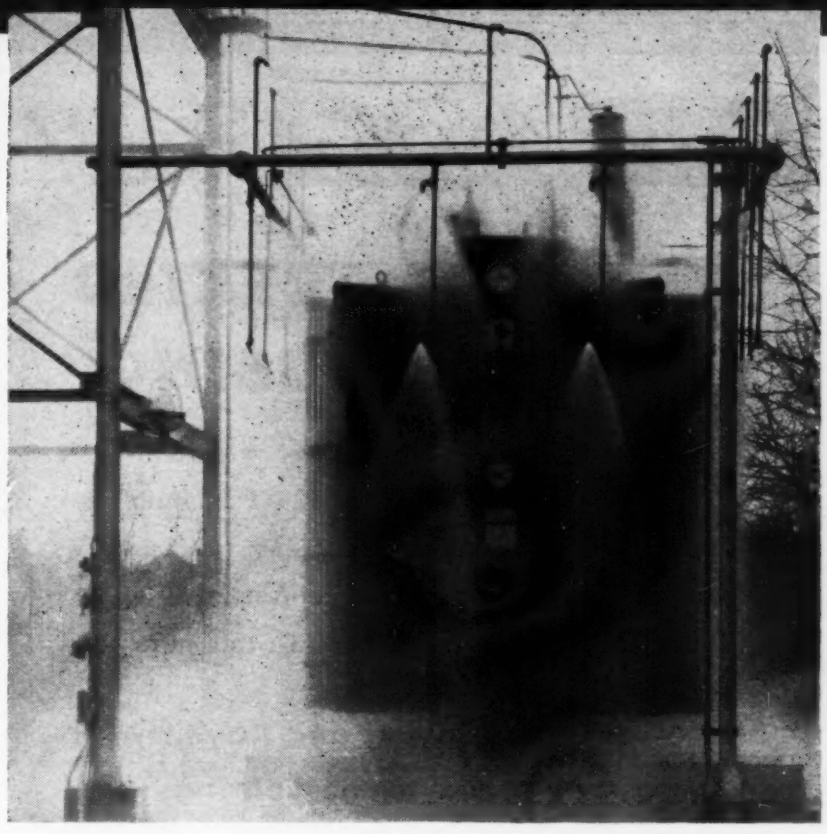

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AUTOMATIC FIRE PROTECTION

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SUCCESSFUL SILICONE SLEEVING

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SYNTHETIC TREATED
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Combining maximum flexibility with temperature resistance up to 400-425° F... Built to meet or exceed VTA or ASTM specifications or to your specification. Available in colors. Any lengths from an inch to a mile!

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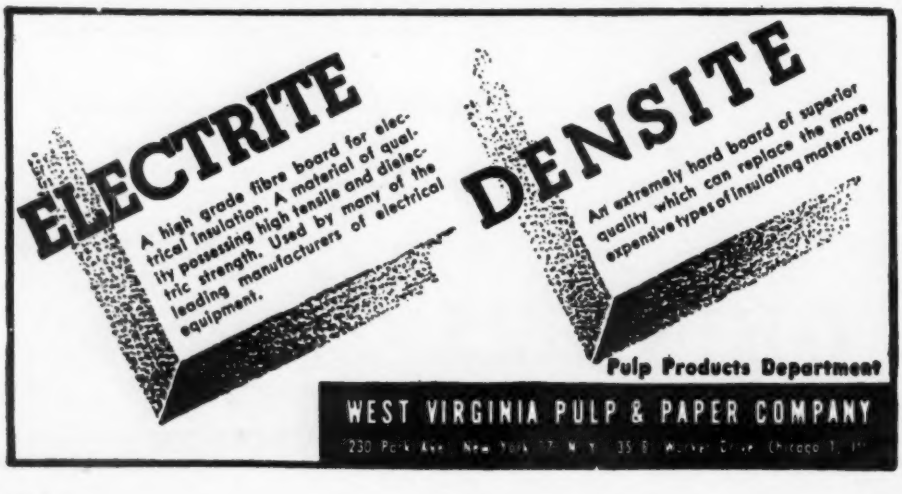
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DENSITE
An extremely hard board of superior quality which can replace the more expensive types of insulating materials.
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Recent Rate Changes

INDIANA PUBLIC SERVICE COMMISSION has reported to the Governor that utility rate reductions totaling $4,078,000 have been made thus far in 1946. The figure was included in a special report of commission accomplishments in the year and came as a result of a request last February by the Governor that savings to the public utilities resulting from abolition of the excess profits tax be passed on to consumers.

ARKANSAS MISSOURI POWER CORP.'s new rate schedule, calling for a $45,000 annual reduction in electric rates to industries, municipalities and cooperatives has been approved by the state Public Service Commission. Previously the commission had approved a commercial and residential reduction.

INDIANA SERVICE CORP. has filed with the state Public Service Commission a new and lower rate schedule for the 14 Indiana counties in which it operates. The lower rate schedule, applicable to territory exclusive of the Fort Wayne area, will result in an annual savings of approximately $25,000 to residential and commercial customers in towns and rural areas served by the utility. Lower rates will apply to July consumption, to be billed in August.

BEATRICE (NEBR.) municipal electric plant customers received their second rate reduction in less than a year as a 10 percent cut in energy charges became effective last month. The city council ordered the reduction because increased output of electricity and improved service have cut operating costs. The reduction will save customers approximately $6,000 a year.

OHIO PUBLIC SERVICE CO.'s consumers in more than 14,000 homes in Mansfield will save $35,000 annually under a new electric rate ordinance, effective June 30. The city also expects to execute another contract with the company, reducing street lighting costs by $35,000 a year.

MURFREESBORO (TENN.) ELECTRIC DEPARTMENT has announced that local electric rates will be reduced an average of 16 percent effective with bills after July 15, to afford local consumers a total estimated annual savings of $43,000. The reduction will include removal of the 10 percent surcharge on commercial and industrial bills. It was explained that the new rates would give residential users savings of about 12 percent; small commercial users about 20 percent; large commercial and industrial users about 19.6 percent and the City of Murfreesboro, on its street lighting costs, about 7.8 percent.

JONESBORO (ARK.) Water and Light plant has announced a new rate reduction for small commercial and industrial users of mechanical refrigeration and air-conditioning service. The new air-conditioning rate is a reduction of about 15 to 20 percent under present rates and applies for the period from May 1 to October 15.

•

G.E. Producing FM Radios

General Electric Corp. began recently production of FM radio receivers, according to Arthur A. Brandt, general sales manager of G.E.'s electronics department. Dealers will receive the first new FM model early in August, he said.

The set will be console models combined with phonographs. Additional FM receivers, including table models, will go into production in August, he added.

•

Manufacturers Issue Earnings Reports

Among the electrical manufacturing companies that recently issued reports on earnings are the following:

Electric Controller & Manufacturing—For 1945, net profit, $344,020, against $326,229 earned in 1944; net sales, $3,440,528, against $3,347,939.

Square D—March quarter, net profit, $356,105, equal to 26 cents each on 1,377,480 common shares, against $446,376 or 32 cents a share, last year.

Canadian General Electric—For 1945, net income of $2,181,049, comparing with $2,120,557 in the previous year. Current assets at the year-end totalled $26,990,057; current liabilities of $7,103,220 left working capital of $19,886,837, against $21,763,146 at the end of 1944.

Babcock & Wilcox—Net income, $4,031,070, equal to $6 each on 671.970 capital shares, compared with $2,931,256, or $4.36 a share, in 1944.

•

Synthetic Jewel Hardening Done by New Process

Synthetic spinel jewel bearing and performance studies in Germany have revealed a new process for hardening. This was made known in a report, No. PB-17545, by M. H. Barnes for the Joint Intelligence Objectives Agency.

The hardening process involves heating the spinel up to 950 or 1,050 deg. C. for twelve hours. This precipitates the excess alumina and converts it into a different form. As a result, the clear spinel turns cloudy and becomes harder. Polish of the bearing surfaces after the heat treatment is completed is accomplished in the usual manner with diamond powder.

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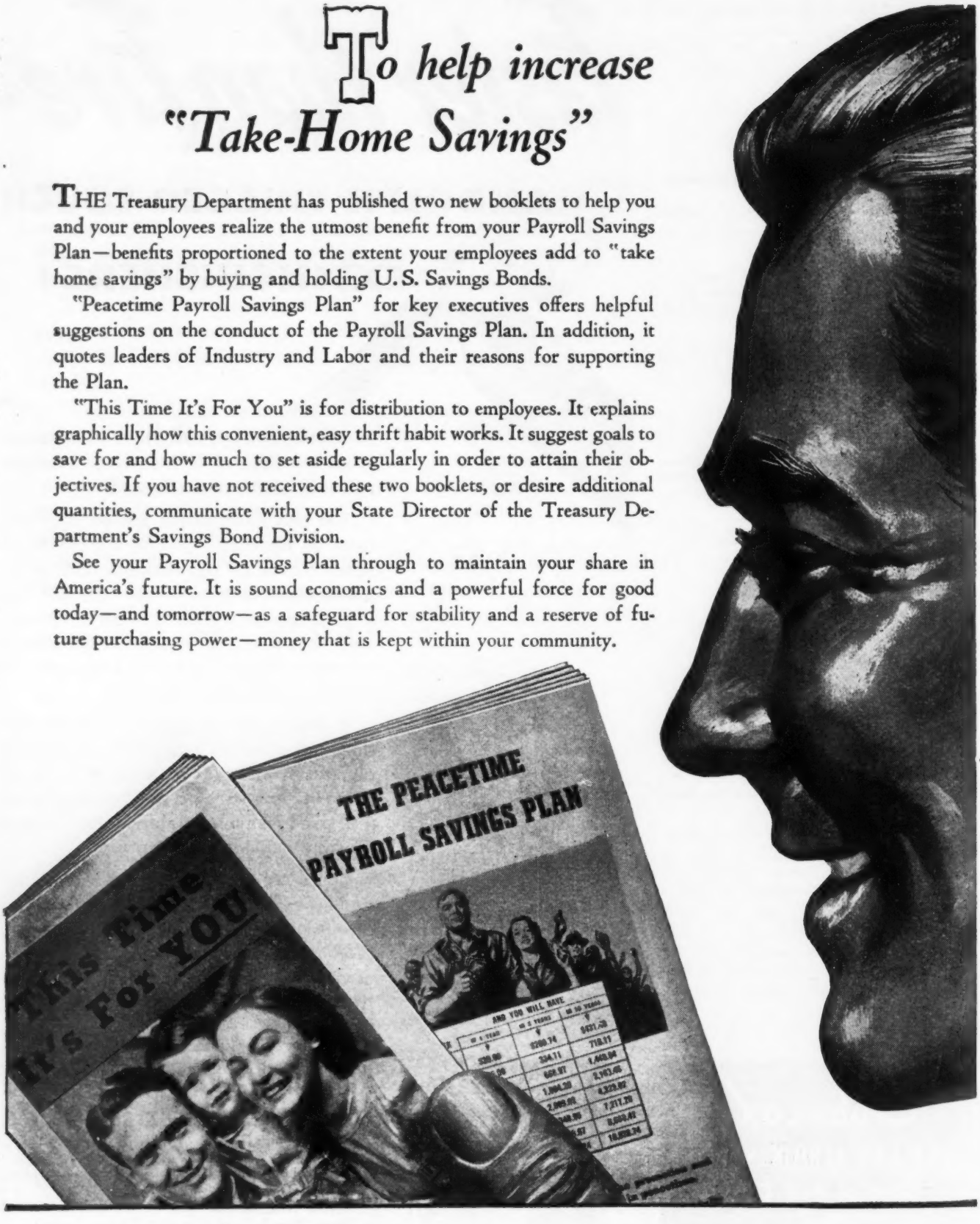

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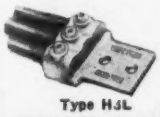
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LETTER TO THE EDITOR

Transformer Connections To Boost Voltage

To the Editor of ELECTRICAL WORLD:

I read with some interest the article entitled "How to Connect Transformers for Use as Voltage Boosters" in ELECTRICAL WORLD, April 13 issue, page 156. It

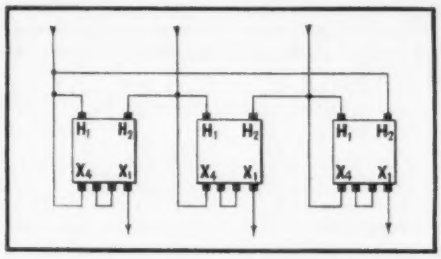

FIG. 1—Transformer connections for voltage boost on a 3-phase circuit

might be of interest to know and an advantage to indicate on the diagram of connections for a 10 percent boost in a 3-phase circuit (shown at the bottom of page 156) that the transformer ratio is 15:1. Accompanying vector diagram in-

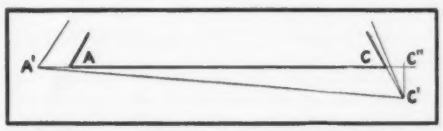

FIG. 2—Vector diagram of voltages (one phase shown for simplicity). Example: AC=100 percent. AA'=10 percent. CC'=10 percent. Angle at C=60 deg. Then CC"=5 percent and C'C"=8.66 percent. Angle CC"C'= right angle by construction. A'C"=115 percent. Then $A'C'=\sqrt{115^2+8.66^2}=115.3$ percent.

dicates the resultant voltages. In addition, if transformers of 10:1 ratio were used, the voltage boost would be 15.3 percent when the secondaries are connected in series, and boost is 7.6 percent with paralleled secondaries.

The accompanying diagram will be helpful to show the connections correctly and more clearly, by using a large dot to indicate connecting lines as in the single-phase diagrams.

Lester H. Faulkingham
Distribution Engineer
New Hampshire Gas and Electric Co.
Portsmouth, N. H.

(Note: Some of the dots to indicate connecting lines were inadvertently omitted when the diagram was redrawn for publication.—Editor)

Matthews Stazrite Guards

shown above and below have no hardware on them. They are attached to the guy wire at the top and to one of the bolts of a three-bolt clamp at the bottom. They become a part of the guy fixture and can not vibrate loose, turn over or be made a greater hazard by "one-arm drivers." The upper photograph shows the 14-gauge half round and the lower photograph shows the 16-gauge full round types. Send for Bulletin 301. Try them at our risk of your approval.

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